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ELECTRICAL WORLD

Time to Prepare for the Air-Conditioning Load

Distribution facilities will have to be revamped if the air-conditioning load is to be adequately served. The load will soon be on the lines. Engineers and executives should plan now to meet it.

A New Control for Pipe Line Electrolysis

For an outlay of roughly two per cent of the cost of the pipe line oil and gas transmission facilities may be fully protected against stray return currents.

Publicity and Sales Approach to the Rate Problem

President A. B. West of Southern Sierras Power tells nine important factors in his approach through planned advertising.

Watt-Hours Are Cheaper Than Burrs

Ginning a bale of cotton takes 18 to 30 kw.-hr. Zero-cost fuel in the shape of burrs from the "bollie" cotton can be hauled away more cheaply than it can be burned to supply power to compete with the electric way.

How to Design Ground Wires for Direct-Stroke Protection

Simple working curves will enable practical application of involved theories to lightning protection. Ground wire design becomes a routine calculation.

MARCH · 17 · 1934

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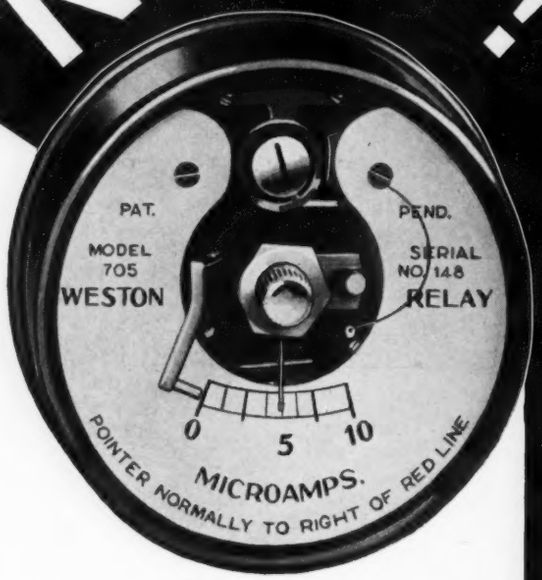

WESTON MODEL 705
Contact-making Indicator
Size, 3¼" diameter, made for either flush or surface mounting, single or double contact. Scale may be calibrated for current, voltage, temperature, etc.

THE WESTON *Supersensitive* CONTACT-MAKING INDICATOR

low operating values • high contact capacity
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Here is a sensitive relay that will make contact on values down to three microamperes or one millivolt, with contacts capable of handling five watts at 110 volts, non-inductive load. It's the new Weston Model 705 . . . the first relay of such sensitivity ever produced capable of handling this amount of energy on its contacts.

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Model 705 greatly broadens the fields of application for sensitive relays and simplifies many existing problems. It permits of control by means of small electrical quantities such as are generated by photo-electric cells, thermocouples, etc. It has been found ideal for alarm and protective systems, smoke-detection devices, paper-break detectors, etc., as well as for temperature control.

Complete information on Weston Model 705 Contact-making Indicator and other Weston relays is available and will gladly be sent on request . . . Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *Instruments*

ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

We had a pleasant visit with David Lilienthal of the T.V.A. last week. What a job that is! The rehabilitation of a region, including all the details required to get human beings, industry and power tied into a balanced and stable economy. Despite the difficulties and the complexities, the task is fascinating to contemplate. It is not quite so fascinating to conduct the actual operations in this impatient world. At least we gained that impression.

●

After a week of code criticism and another week of code authority and NRA discussion it is still difficult to tell just what is of ultimate significance. Above everything else, the pressure from above to increase wages and shorten hours without increasing prices stands out. How this paradox can be solved, especially for the hard-pressed heavy equipment industries, is not stated. As a matter of realistic approach facts must be faced, however sympathetic one may be to the theories involved, and the present course is not the road to recovery, though it may be the road to temporary reemployment.

●

Electrical energy production continues to show amazing contra-seasonal gains. The whole industry should sit up and take action. The opportunity is here to make the next few months surpass all past accomplishments in sales for a corresponding period.

●

It is most encouraging to find electrical business to be looking up in Great Britain. There is a feeling of optimism, an aggressive business-getting program and a growth in sales that have been absent in past years. Nationally, Britain is doing well too, with a budget surplus. Just muddling through successfully without reform insistencies.

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March 17, 1934

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ELECTRICAL WORLD—Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries $9, or 36 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.

Printed by The Schweinler Press, N. Y.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42d Street, New York, N. Y.

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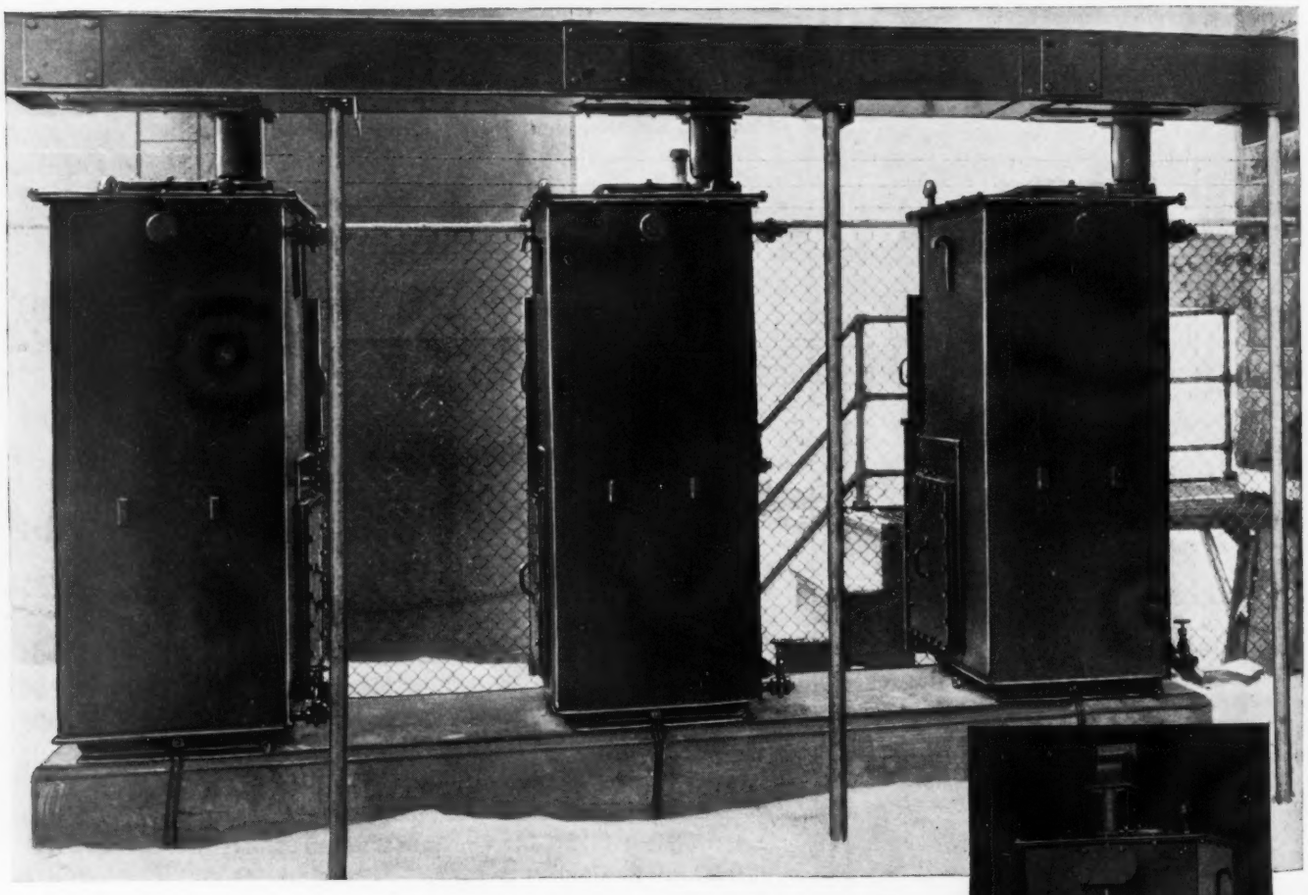

An installation of three 72 KVA, 300/600 ampere, 2400 volt Type AFR feeder regulators. Note the economy of outdoor construction with leads in conduits. These regulators also include oil-immersed current-limiting reactors built integral ... another constructional saving possible with AFR regulators.

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ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

March 17, 1934

L. W. W. MORROW, *Editor*

Electrify America—Sell for Prosperity

RECOVERY for the electrical industry lies in increasing its annual sales volume. This definitely requires enormous expenditures of money in sales promotion and in direct selling expense. It means taking a chance upon more ultimate volume by the initial use of low-priced products and low rates. It necessitates an industry organization to sell. It is the responsibility of the industry itself to get the money, to formulate the plans and to do the work.

But it may be said that the industry is not in a position to spend money, to raise money or to create sales expenses. Manufacturers record deficits, utilities are crushed by low rates and high taxes. True enough, but what choice is there? No one will help the industry without being spurred by its own initiative. Some method and some plan must be found to bring prosperity through investments to get greatly increased sales.

In the past, electrical enterprise has taken chances that were unspectacular. It has a splendid but conservative record in sales. The present desperate situation requires taking greater chances. It necessitates doing old things in a new way and doing new things. The utilities cannot sit back and expect the millions of low-use, non-profit customers to increase their use automatically. The range manufacturers will not get anywhere sitting contented with selling 45,000 ranges and 12,000 water heaters for some $3,000,000 each year. Even the sale of five lamp bulbs per customer per year is nothing to brag about. All must face the fact that it would take at least $60,000,000 to finance, on a self-liquidating basis, a five-year sales program that would get sales of products and use of energy advanced to the level needed to sustain industry prosperity. All know that the first years of this period would result in a loss because of the small volume and the large expense; also, all know that volume will not be had on a self-sustaining basis without making the promotional expenditures.

THUS the hurdles on the road to prosperity are money, an organization for selling and a plan for selling. The money could probably not be had from private sources, but funds for a national electrification program could be obtained from the government or a government agency. The administration is sympathetic to the idea of an electrified America. It has instituted utility yardsticks in specific locations. It has established the Electric Home and Farm Authority. It wishes to revive industry and to bring back prosperity to the capital goods group. Why, then, not develop a national electrification sales plan and mechanism to be put to work by the electrical industry and then go to Washington to get the funds required at a reasonable cost? The investment would be sound, the project is worthy, the chances of failure are few and the social and economic results expected are attractive in every aspect.

There is no alternative to action except stagnation or disaster. Why not organize the industry for a real sales program with national and regional promotional committees to activate

the direct selling outlets to get the business? Why not attempt to develop this program upon the basis of the use of government funds as a self-liquidating project in the spirit of the New Deal? This industry has the products, the services, the man power and the experience to carry out this life-saving project. Why not get to work before the national and federal scene changes?

RATES

For many reasons there has grown up an insistent public demand that light and power rates be reduced. In such a period as this it is to be expected that the average citizen will look at his monthly bills and protest items that have increased or that he feels to be out of line with reductions that have occurred in others. He does not delve deeply into reasons or facts particularly when he is exposed to the prevailing anti-utility sentiments expressed in the public press and to unfair rate comparisons made for political purposes.

As a consequence of these conditions light and power companies have reduced rates on a broad scale. Estimates of consumer savings by the Federal Trade Commission exceed $118,000,000 for the 1930-33 period. As a whole these rate reductions have not been justified, but were made in response to public demand and in the hope that lower charges would be effective in so increasing use as to lead to adequate revenues. While these reductions have been made intelligently and embody the development and use of better rate forms, particularly inducement schedules, to stimulate use, there are obviously limits to the policy. Comparative electric rates are lower than commodity prices and costs of government and are so low as to jeopardize, in some instances, the credit of the utilities. The latter face increased taxes, increased expenses under the codes and inability to get new money or to refund existing securities. In many instances costs of operation have been cut so drastically as to affect service standards and maintenance.

How can this direct pressure for rate reductions be relieved? One way is to get the facts before the public convincingly. An outline of a good method to do this through advertising is given in this issue by A. B. West of Southern Sierras Power. But this approach should be supplemented for every employee of the utilities and other electrical industry branches should know the facts so that, in their personal contacts, they can correct misconceptions and errors. Utility books may be open to all, but to understand the facts and to bring them to bear in a constructive effort that a better realization of true conditions may be gained by the public takes intelligent planning and hard work. It is in the interest of the public as well as in the interest of the utilities to have the present pressure for rate reductions relieved. The industry believes in low rates and has instituted them, but this principle should not be carried to the extreme of destroying an essential industry or of preventing it from carrying out its sales and service programs, so necessary to national welfare. The responsibility for correcting the situation rests squarely upon utility executives.

FACTS

Year-books of progress on central - station sytems were a pre-depression development of some value to public relations. These furnished interesting reading in the heyday of prosperity and gave both utility people and others excellent pictures of an expanding era in power supply. Economic necessity has eliminated much of this kind of publicity, but the importance of interpreting utility policies and local company affairs to communities is greater than ever. Realizing this, the Connecticut Power Company of New London has just issued a report to its customers in addition to the usual annual report to stockholders.

The report to customers reviews the past year's operations of the company in simple language, avoiding obscure technical terms and offering to furnish additional information of any kind to any customer on request. It devotes much attention to emphasizing the common interests of company, stockholder and employee; features the importance and definite local results of greater use of electricity as the key to lower rates, and hence toward lower prices of appliances; explains the fairness of the area charge in residential rates; sets forth various misunderstood aspects of billing and collections; clarifies the popular viewpoint with regard to governmental competition, and warns its readers as voters that in their hands alone resides the power to check and control the perilously rising taxation burden.

A plain and unvarnished exposition of company ownership, dividend requirements, certain aspects of plant problems, metering, and other live topics, including merchandising policies, add interest to its fifteen pages. Propaganda? Certainly, in the sense that increased patronage and better understanding are objectives, but when did any business or its customers lose anything by frankness and friendly taking of counsel?

RENEW

Economic savings have long been associated with comprehensive modernization jobs, but step-by-step modernization is finding more favor with many executives who prefer to go forward slowly under present conditions. In a typical plant in the metal-working field modernization has been under way for much of the past two decades. Coincident with the establishment of adequate technical authority to bring about improvements the shops have gradually been rewired; alternating-current motors have slowly superseded direct-current equipment, but have never replaced it generally; electric furnace service has been installed; switchboard facilities have been centralized; conduit has replaced open-wire feeders in many buildings; operating routine has been improved until it measures up to excellent power company practice, and old steam-generating units have been held in reserve while purchased energy has come in with the utilization of synchronous motor-generator sets for power-factor correction and bonus payments to the customer. Shop lighting has been greatly improved and many excellent applications of industrial reflectors have eliminated glare at individual machines, aiding production by removing an insidious annoyance.

BY persistent, steady work along betterment lines a truly revolutionary change has been effected in the electrical plant over this period. The management has preferred to spread the burden over the years to making drastic and sweeping modifications at one time. The policy has been to avoid overtime work, increased costs due to rush orders for electrical equipment, mass appropriations for apparatus and interference with regular departmental production. Close attention has been given to planning for internal feeder control while making changes from alternating to direct current supply, with simple identification of switches operating on each type of service.

The plant has always been mainly group-driven, but gradually larger motors have been replaced by motors driving smaller groups of productive machines, permitting more flexible and economical operation with varying product demands under purchased power. Inspection of electrical equipment has been put on a new plane of system and thoroughness and interruptions have been cut from three or four per week to rare occasions. Recently a department has been fully equipped with new group drives controlled by across-the-line starters, but the management has not been persuaded that it would pay to go to full individual drive up to the present time. The moral of this plant's history may not appeal to advocates of comprehensive modernization made in a very few major changes, but it at least proves that gradual betterments can be integrated into a surprisingly respectable total if the managerial policy is to press steadily, even if lightly, forward from one year's end to another.

CHANGE

New principles of production in industry are being applied under the pressure of present conditions. One is the principle of production control so that products flow through a factory directly from raw material to finished product. This permits the use of labor more efficiently and reduces direct operating, accounting and overhead expenses because it saves time, forms, labor and factory movements. It also replaces the older concept of departmentalization by processes and the specialization of labor according to skill in one operation.

Straight-line production requires the assembly of machines at one point on the path through a plant even when non-standardized and job-lot products are made. It requires the operations of several machines by one man, who is busy but not pressed, and necessitates a greater amount of idle machine time. An operator may utilize a lathe, a drill press, a heat-treating furnace and a grinder at his point on the line, with a consequent increase in his competency and his compensation, but a decrease in the time efficiency of the individual machines.

Recent examples of this type of production show remarkable results and are significant to those who supply equipment to industry. Electrical instruments, controls, motors, furnaces, switches, conveyors, trucks, hoists, thermometers and gages make it possible for an operator to get quality in performance and to do multiple machine operations. A new type of electrical wiring and distribution is required for factories so that flexibility may be had in production. Machines must be mobile and must be connected to their power supply readily and quickly at any place. A new market and a new approach to sales is made possible for the rehabilitation of the buyer, the seller and the worker. These new principles, new equipments and new methods for sales and production should be exploited by electrical manufacturers and utility power salesmen.

Pipe-Line Maintenance Costs Cut by Cathodic Protection

By E. S. KNOX
Industrial Division
Westinghouse Electric & Manufacturing Company, Los Angeles

H. J. KEELING
Southern Counties Gas Company of California

Cathodic protection of pipe lines at an outlay of 1.6 to 3.1 per cent of the cost of the line can save all the cost of reconditioning the protective coating at the end of a ten-year period. This reconditioning cost is high—half or more of the original cost of the line. A mile of new pipe can be protected at an annual outlay of $15 to $25; old lines cost more to protect, from $72 to $100 per mile per year.

With a.c. service available near a new pipe line an inexpensive rectifier readily supplies the few amperes needed at 5 volts or less. Elsewhere a gravity battery has been used. Up to 10 miles has been drained by a cathodic unit.

ELECTROLYSIS problems in which metal is removed from underground structures by stray railway negative return currents are commonly solved by bonding the structure to the tracks or the negative return feeder in the railway substation. In this way the structure being attacked is maintained at the same potential as, or slightly negative (cathodic) to, the structure to which the current is flowing, and thus is said to be receiving cathodic protection.

This principle may be applied in any case where corrosion is due to electrolytic action whether caused by stray currents or by the chemical action of the electrolyte on the structure. It has been used for the protection of steam condenser tubes, underground cable sheaths and buried water and gas pipes. In the past few years cathodic protection has been employed to mitigate corrosion on long gas transmission pipe lines.

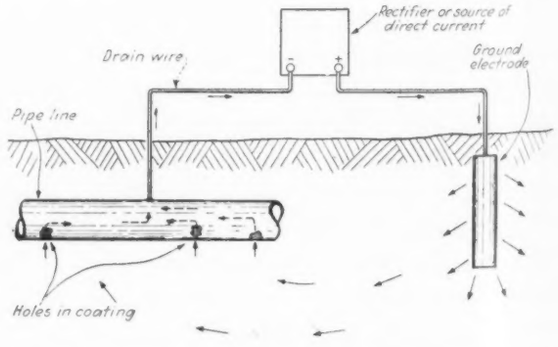
External corrosion problem in new pipe lines

Major corrosion problems on long transmission pipe lines do not result from stray current electrolysis because they are usually located in open country, far from electric railways. In most cases the pitting is due to the chemical action of the soil on the metal.

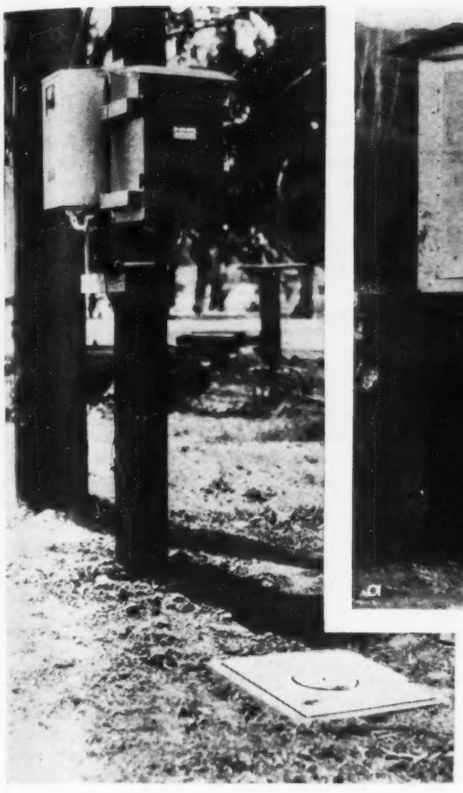
In the very damp, alkaline soil encountered in several districts served by the Southern Counties Gas Company the life of an unprotected steel pipe may be less than five years. A good protective coating on such a pipe might be expected to increase its life to ten years or more; however, it is never possible to apply, for any reasonable cost, a protective coating that does not have defects which leave the pipe exposed at pinholes or occasional breaks in the coating. The pipe tends to corrode wherever these defects occur. In case the pipe line is anodic with respect to the soil due to stray current electrolysis or long line currents the density of the current leaving the metal at the bare spots will be much greater if the pipe is insulated than would be the case if it were bare. The pitting under these circumstances will be very severe.

The cost of cathodic protection is largely governed by the electrical resistance of the pipe coating. If the coating does have a high resistance, as is obtained, for example, with coal tar enamel, the cost of applying cathodic protection will be comparatively low. It will be necessary to drain very little current in order to maintain the metal cathodic with respect to the soil. Although authorities differ, it is generally considered that corrosion of the iron at the bare spots will be stopped when the potential of the metal is 0.3 volt or more cathodic with respect to the soil. It is desirable to keep this potential difference close to the required minimum in order to save energy costs and in order to reduce the possibility of destroying the insulating coating by the osmotic action of the current flowing through it.

When the Southern Counties Gas Company drew up its plans for the construction of 80 miles of 12 3/4 in. welded steel pipe line for the transmission of natural gas at high pressure along the seacoast from the Huntington Beach oil fields to San Diego it was decided to provide cathodic protection wherever economies could be expected from its use. A complete soil survey was made by the electric conductivity method, and the protective coating selected for the different sections was governed by the corrosivity of the soil in that vicinity. Bare pipe was installed in the areas where the survey

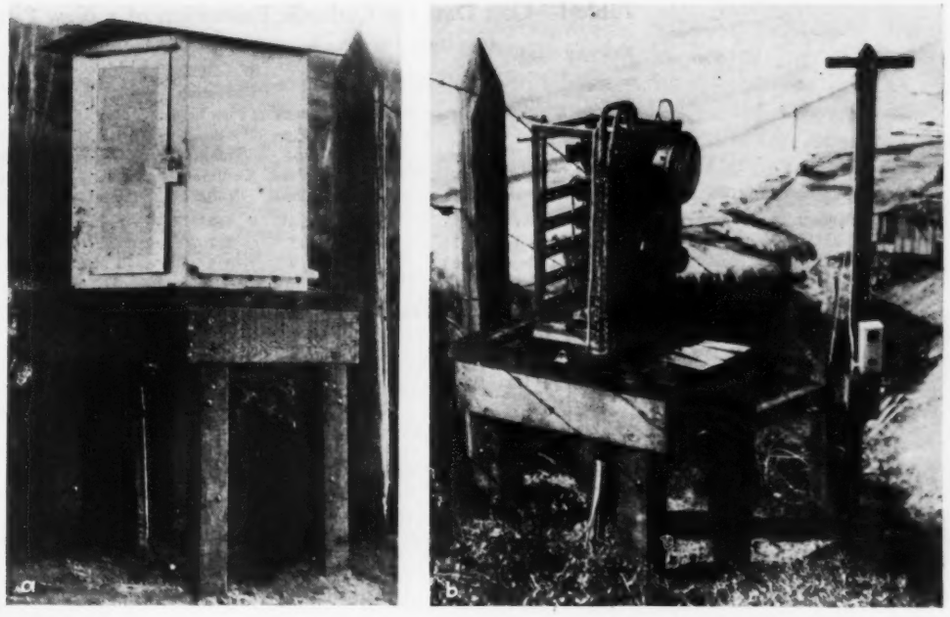


Rectifier reverses current flow from pipe to soil which attacks it by electrolysis



Rectox unit on the pole, ground electrode in small concrete vault

This cathodic protection station at Huntington Beach protects Section 1 of the San Diego pipe line, for which costs are detailed in Table I.



Platform mounts cathodic unit at Crystal Cove for Section 2 of San Diego line

(a) Unit in locked cabinet, (b) graphite ground anode is installed under water in the beach in the background. Four of the steel test specimens lie on the platform in front of the rectifier.

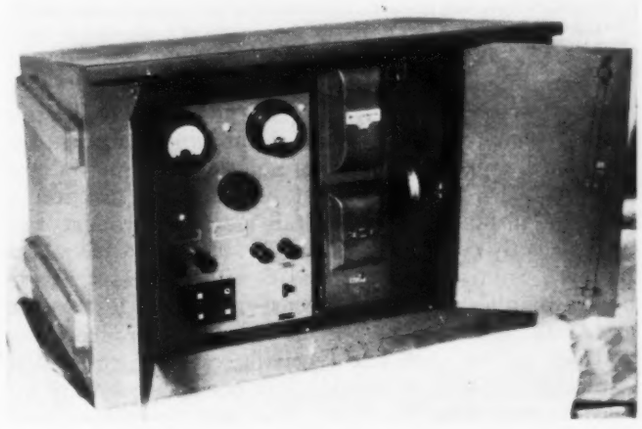
indicated that the soil was not corrosive in its composition.

The pipe line is divided into sixteen major sections, insulated electrically from each other by sleeve couplings in order to separate the coated sections from the bare ones. The sections are of various lengths between 1 and 12 miles. Most of the coated sections are protected with a covering consisting of two coats of coal tar enamel, applied hot, and an unbonded asbestos felt wrapper.

Coatings of this type have a high resistivity. Tests were made on several sections when the pipe line was first installed, and the average resistance of the coating was determined by measuring the potential drop between the pipe and the earth while draining a known intensity of current from the line. The lowest value for the resistance of the coal tar coating was 30,000 ohms per square foot and the highest value 4 megohms per square foot.

The design and installation of all the cathodic protection stations for this pipe line have not yet been completed. Table I shows the actual cost of the installation and the estimated maintenance and fixed costs for the drainage stations now in operation. Most of the energy cost involved in applying cathodic protection to a pipe line having a coating of high resistivity is due to the resistance of the circuit through which the current is returned to earth. In designing these stations particular care was taken to provide a ground connection, or anode, which would return the current drained from the pipe line with as little potential drop as possible.

Section 1 is drained by a full-wave "Rectox" rectifier installed



Section 3 will have six 17½-volt, 35-amp. d.c. motor-generator sets like this for cathodic units

in the center of the section. The connection to ground is made through a 20-ft. length of 6-in. steel pipe installed vertically in the earth with 600 lb. of rock salt packed around it.

The equipment installed on Section 2 is similar to that used on Section 1. However, the ground connection consists of a graphite rod 4 in. in diameter and 48 in. long, buried horizontally below the tide level in the wet sand of the ocean beach.

Section 5 is situated in a district where electric power is unavailable for any reasonable cost. Since this section is fairly short, and the pipe coating has a very high resistance, it is possible to use a battery of two gravity cells as a source of power. These cells are constructed from 20-gal. jars and each contains 50 lb. of zinc. The ground connection consists of a 4-in. diameter graphite rod, buried vertically in a salt water slough.

In order to determine the value of the cathodic protection installations in mitigating the corrosion of the pipe line small, weighed, bare steel test specimens are buried in pairs near the pipe line, at the centers and extremities of the sections. One specimen of each pair is connected to the pipe line to give an index of the

Table I—Cost Data for Cathodic Protection of a New Pipe Line

(San Diego Pipe Line — 12¾-in. O. D. Welded Steel)

Section Number	Location of Drainage Station	Type of Equipment Used	Current Drained (Amp.)	Potential Across Station Terminals (Volts)	Length of Pipe Line Drained (Miles)	Minimum[5] Reduction of Pipe Line Potential Due to Draining (Volts)	Total Cost of Installation (Dollars)	Annual Cost, Dollars: Energy Cost (Dollars per Year)	Maintenance[1] and Fixed Costs (Dollars per Year)	Total Cost of Cathodic Protection (Dollars per Year)	Total Cost of Cathodic Protection (Dollars per Year per Mile of Pipe Line)
1	Huntington Beach	Rectox rectifier	3.8	5.4	5.6	1.0	$302.00	$24.00[2]	$60.00	$84.00	$15.00
2	Crystal Cove	Rectox rectifier	5.3	5.3	10.7	0.7	$583.00	$31.00	$117.00	$148.00	$13.80
5	Loma Alta Creek	Gravity battery	0.03	2.0	1.4	0.5	$160.00	$4.00[3]	$32.00	$36.00	$25.70

Table II—Estimated Cost Data for Cathodically Protecting an Old Pipe Line

Name of Pipe Line	Type of Equipment Used	Current Drained (Amp.)	Potential Across Station Terminals (Volts)	Number of Drainage Stations	Length of Pipe Line Drained per Station (Miles)	Total Length of Pipe Line Drained (Miles)	Minimum[5] Reduction of Pipe Line Potential Due to Draining (Volts)	Total Cost of Installation (Dollars)	Annual Cost, Dollars: Energy Cost (Dollars per Year)	Maintenance[1] and Fixed Costs (Dollars per Year)	Total Cost of Cathodic Protection (Dollars per Year)	Total Cost of Cathodic Protection (Dollars per Year per Mile of Pipe Line)
Section 3[4], San Diego pipe line (12¾-in. O.D. welded steel)	Motor generator	35.0	7.5	6	2.1	12.6	0.3	$2,750.00	$705.00	$550.00	$1,255.00	$99.60
Ventura-Oxnard pipe line (6⅝-in. O.D. welded steel)	Rectox rectifier	17.5	7.5	4	1.9	7.7	0.3	$1,650.00	$230.00	$330.00	$560.00	$72.80

[1]Estimated at 20 per cent of the capital investment, distributed as follows:

	Per Cent
Maintenance	2.2
Interest on investment	7.5
Depreciation (ten-year life at 6 per cent)	7.5
Taxes	2.8
	20.0

[2]Minimum service charge.

[3]Estimated cost of battery elements and electrolyte used.

[4]This section was built four years before the main San Diego pipe line was constructed and is coated with a grease and cloth wrapper which has a very low resistance.

[5]This value represents the amount that the potential of the pipe line is made more cathodic with respect to the soil.

corrosion occurring on the bare metal. The other specimen is left unconnected and gives an index of the rate of corrosion that would exist if the pipe line were not cathodically protected. At present no data have been accumulated for the rates of corrosion on Section 1, since the installation of the drainage equipment has just been recently completed. However, test plates have been removed from Sections 2 and 5 after an elapsed time of six months. The unprotected specimens lost weight at a rate fifteen times greater than did the specimens attached to the pipe line receiving cathodic protection. Although cathodic protection has been successfully applied to pipe lines in a wet, acid soil, this probably is one of the first cases where it has been extensively used in a dry, alkaline soil. There has been some doubt expressed as to the effectiveness of cathodic protection in an alkaline soil. However, the results obtained seem to refute this.

Evidence that the corrosion on a pipe line has advanced to the stage where the walls are perforated is usually shown by the leaks that develop. At first it is possible to repair these breaks at a reasonable cost, but as the line becomes older the perforations develop at more frequent intervals and the maintenance cost becomes excessive. Eventually, it is more economical to recondition the entire pipe line than to repair the individual leaks.

However, in some cases the cost of reconditioning is greater than the cost of building an entirely new line. If, for example, the pipe line passes beneath roads which have been recently improved, it may be covered by a deep layer of filled earth or by a heavy concrete pavement. Reconditioning under these circumstances would necessitate digging a very deep ditch or cutting pavement; both very expensive procedures. In such

Table III—Estimated Reconditioning and Cathodic Protection Costs for Section 3, San Diego Pipe Line

Total cost of original pipe line $169,000
Total cost of reconditioning (estimated) 82,650

Assume that the reconditioning work will be done at the rate of 1/10 per year for the next ten years starting in 1933.

$$\text{Maintenance cost} = \frac{\$82,650}{10} = \$8,265 \text{ per year}$$

Assume that cathodic protection will stop further corrosion of the metal and deterioration of the coating and thus avoid the reconditioning outlay, then:

Year	Annual Cost of Reconditioning	Annual Cost of Cathodic Protection	Annual Saving Due to Cathodic Protection	Value of Saving in 1943 at 5 Per Cent Compound Interest
1933	$8,265	$1,255	$7,010	$10,875
1934	8,265	1,255	7,010	10,357
1935	8,265	1,255	7,010	9,864
1936	8,265	1,255	7,010	9,394
1937	8,265	1,255	7,010	8,947
1938	8,265	1,255	7,010	8,521
1939	8,265	1,255	7,010	8,115
1940	8,265	1,255	7,010	7,730
1941	8,265	1,255	7,010	7,360
1942	8,265	1,255	7,010	7,010
	$82,650	$12,550	$70,100	$88,173

Saving due to the use of cathodic protection as of 1943, if the line is abandoned at that time $88,173

If the line is continued in service for an additional ten years, the annual cost of cathodic protection, starting in 1943, will be:

If the line has not been reconditioned	$1,255
If the line has been reconditioned	200
Difference	$1,055

If the line has not been reconditioned the annual cost of cathodic protection after 1943 will be $1,055 greater than if it had been reconditioned.

The amount of the fund that must be set aside at 5 per cent compound interest to provide $1,055 annually for ten years $8,555

The net saving as of 1943 due to the use of cathodic protection if the line is continued in service until 1953 is ($88,173 — $8,555) $79,618

Table IV—Estimated Reconditioning and Cathodic Protection Cost for 6⅝-In. O.D. Ventura-Oxnard Pipe Line

Total original cost of pipe line	$53,000
Total cost of reconditioning (estimated)	32,600
Assume that it is necessary to recondition 2½ miles of the pipe line immediately (1933) and to recondition the remainder within ten years at the rate of 1/10 per year, starting in 1934.	
Total cost of reconditioning 2½ miles	10,600
Total cost of reconditioning the remainder	22,000

Maintenance cost starting 1934 = $\frac{\$22,000}{10}$ = $2,200 per year.

Assume that cathodic protection will stop further corrosion of the metal and deterioration of the coating:

	Annual Cost of Reconditioning	Annual Cost of Cathodic Protection	Annual Saving Due to Cathodic Protection	Value of Saving in 1943 at 5 Per Cent Compound Interest
1933	$10,600	$560	$10,040	$16,400
1934	2,200	560	1,640	2,540
1935	2,200	560	1,640	2,420
1936	2,200	560	1,640	2,310
1937	2,200	560	1,640	2,200
1938	2,200	560	1,640	2,100
1939	2,200	560	1,640	1,980
1940	2,200	560	1,640	1,900
1941	2,200	560	1,640	1,800
1942	2,200	560	1,640	1,720
1943	2,200	560	1,640	1,640
	$32,600	$6,160	$26,440	$37,010

Saving due to the use of cathodic protection as of 1943, if the line is abandoned at that time	$37,010
If the line is continued in service for an additional ten years, the annual cost of cathodic protection, starting in 1943, will be:	
If the line has not been reconditioned	$560
If the line has been reconditioned	110
Difference	$450
If the line has not been reconditioned the annual cost of cathodic protection after 1943 will be $450 greater than if it had been reconditioned. The amount of the fund that must be set aside at 5 per cent compound interest to provide $450 annually for ten years	$3,645
The net saving as of 1943 due to the use of cathodic protection if the line is continued in service until 1953 is ($37,010 — $3,645)	$33,365

cases, cathodic protection may prove to be the most economical solution.

It is not possible to draw hard and fast rules as to when cathodic protection should, or should not be adopted. The factors are so numerous that each case must be considered individually. Tables III and IV show the cost data and estimations used by the Southern Counties Gas Company in deciding the feasibility of cathodically protecting two of its old pipe lines. These illustrate one method that can be used for analyzing the problem. Table II shows the details and calculated operating and cost data for the proposed installations. The size and number of stations necessary were calculated by making actual tests to determine the change in the potential of the pipe line when draining various intensities of current.

Referring to Table III, if at the end of the ten-year period it becomes impossible to continue with cathodic protection because of the condition of the coating, the savings accumulated by that time as a result of the use of cathodic protection will be sufficient to recondition the line completely, and the net benefit resulting from the use of cathodic protection will be that the protective coating will be new, rather than one having an average life of five years.

If, however, at the end of the ten-year period it is still possible to continue cathodic protection for an additional ten-year period, a net saving of approximately $80,000 will have resulted.

This same reasoning applies to the second example, shown in Table IV, except that the net saving in this case will be approximately $34,000.

The probability that cathodic protection would reduce the cost of maintaining the two old pipe lines seemed so favorable that the company decided to use it. The installation of several drainage stations has already been completed on Section 3 of the San Diego pipe line and it is expected that within a short time both pipe lines will be under the influence of cathodic protection.

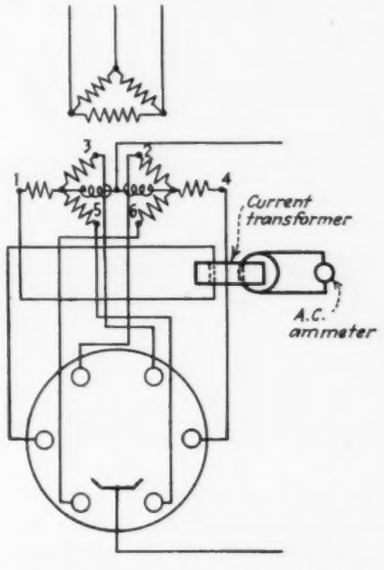
Rectifier Anode Currents With Current Transformer

Just another of those seemingly simple solutions to apparently difficult problems. Mercury-arc rectifier practice is new enough to offer frequent surprises.

By J. H. COX

Mercury Arc Rectifier Division,
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

At first glance a current transformer could apparently not be used to register on an a.c. ammeter the values of individual anode currents in large rectifiers. This decision rests on the unidirectional nature of the irregular current waves. But it has been found possible to indicate one of these currents on an ammeter by passing the opposed currents of two opposed anodes through the primary of its current transformer.



Current transformer and ammeter indicate r.m.s. value of one of two opposed anode currents

These values are often calculated for a mathematically shaped wave. As an approximation, a square-topped wave is often assumed. However, in the practical rectifier the wave is never square topped; it is distorted by the inductive lag in the transfer of current from one anode to the next and the amount of the distortion varies with the load and the reactance of the connected apparatus. Therefore, for a given rectifier circuit and load some form of measuring means is necessary. Since, in large capacity rectifiers, the currents are beyond the capacity of the usual ammeter some form of dividing scheme is necessary and because the usual dynamometer type instrument requires a higher voltage for operation

than that produced by the usual available shunt the use of a shunt is not feasible.

Although a single anode lead can be passed through a current transformer, the results may be inaccurate due to the tendency of the unidirectional current to saturate the current transformer iron and because any direct-current component is not detected in the secondary of a current transformer. To avoid this, the leads from opposite transformer terminals are passed through the current transformer in opposite directions as shown in Fig. 1. Currents in each direction are equal, there is no tendency to transformer saturation and accurate readings may be had with the usual form of a.c. ammeter.

However, in interpreting the ammeter readings, it must be remembered that in order to obtain the r.m.s. current in each lead the meter reading must be divided by the square root of two and not by two. This is apparent from the following analysis:

The r.m.s. current in a circuit with balanced positive and negative wave is:

$$I_s = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} i^2 dt} = \frac{1}{\sqrt{2}}\sqrt{I_1^2 + I_2^2 + I_3^2 + \ldots} \qquad (1)$$

where I_1, I_2, etc., are the maximum value of the various sinusoidal components of the current. However, considering the case where current flows during only one-half of the cycle, equation (1) becomes

$$I_h = \sqrt{\frac{1}{2\pi}\int_0^{\pi} i^2 dt} = \frac{1}{\sqrt{2}}\sqrt{\frac{I_1^2 + I_2^2 + I_3^2 + \ldots}{2}} \qquad (2)$$

$$= \frac{1}{2}\sqrt{I_1^2 + I_2^2 + I_3^2 \ldots}$$

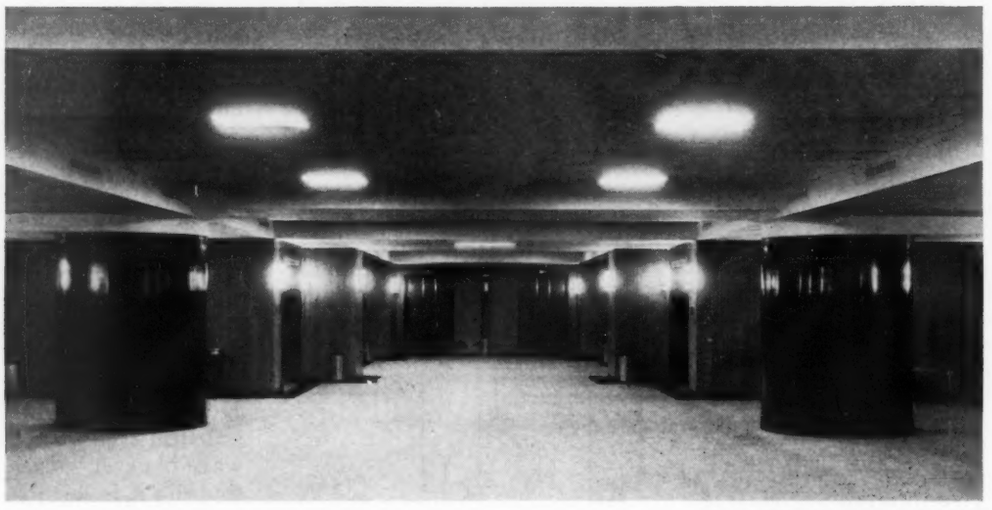
or the value of the integral becomes one-half that in equation (1) and

$$\frac{I_h}{I_s} = \frac{2}{\sqrt{2}} \text{ or } I_h = \frac{I_s}{\sqrt{2}} \qquad (3)$$

It is evident that the meter reading in the case considered, since current flows in both directions, will be determined by equation (1) and that the current desired is specified by equation (2). Then, to obtain the current in an anode lead the meter reading must be divided by the square root of 2, according to equation (3).

Another way of considering the problem is as follows: Assuming the positive and negative waves to be equal in magnitude, a meter carrying a current having waves in both directions will receive twice the energy that it does when one of the waves is absent, and the needle will be deflected twice the distance. However, an alternating-current meter has a scale with divisions proportional to squared values, so the reading in the first case will be only $\sqrt{2}$ times that in the second case.

Satisfactory Lighting With Low Headroom



By A. L. POWELL
Supervising Engineer
Incandescent Lamp Department,
General Electric Company

In the new National Broadcasting Company's studios in Radio City the spacing of floors is about normal, but with the hung ceilings, necessitated by the air-conditioning system, the ceiling height is reduced to 9 ft. or less. With such low headroom it is quite out of the question to use pendant ceiling luminaires and for wide spaces side-wall fixtures do not distribute the light properly. The most logical solution seems to be the use of a flush-type ceiling device with the major part of the equipment in the free overhead space. With such a system, if there is not a happy co-ordination of decoration and color, there is a great tendency for the ceiling to be abnormally dark and the luminous portions be very bright and by contrast quite glaring.

The accompanying illustration showing the eighth floor foyer of these studios indicates what a pleasing effect has been secured. Here the ceiling is 9 ft. and the floor space 50 x 56 ft. There are twelve uniformly spaced recessed boxes, which are 2 ft. square and have a white finished reflector in the form of a truncated pyramid containing four 50-watt "Mazda" lamps. The opening is covered by three removable panels of flashed opal glass. The ceilings are painted buff, the carpet is of medium red, which reflects considerable light toward the ceiling. Walls are walnut, broken by doors which lead to the studios on both sides, and the large columns are black.

On the side walls are 21 luminaires in the form of a half cylinder of flashed opal glass with vertical carved lines, with the opening toward the wall. These have two 25-watt tubular lamps in each. Cox, Nostrand & Gunnison supplied the lighting equipment. The illumination level is 5 ft.-candles.

How to Design Ground Wires for Direct Stroke Protection

By L. V. BEWLEY

Power Transformer Department,
General Electric Company, Pittsfield, Mass.

Proper design of a ground wire installation can be based on simple working curves. Familiarity with theories of lightning, traveling waves and ground phenomena is not imperative.

The author has been prolific in developing these theories, but here he provides a strictly practical solution in no way, however, incompatible with prevailing theories about corona, earth currents, coupling, etc. Ground wire design is thus reduced to a routine calculation.

GROUND wires used for protection from direct strokes should conform to the following requirements:

1. High enough above the line conductors to intercept the stroke (shielding).
2. High enough above the line conductors at midspan to prevent a sideflash during the interval required for reflections from the towers to return to midspan and relieve the stress.
3. Low enough tower footing resistances to prevent flashover of the insulators.
4. If intended for station protection only, the length should be sufficient so that incoming surges will attenuate below the dangerous value (station protection).

Each of these requirements will be considered in detail.

Shielding—Curves and information for caculating the height of ground wire necessary to insure that the stroke will not initially strike a line conductor are given in Fig. 1. The example of Fig. 1 is self-explanatory. It will seldom be found that shielding is a limiting condition in design.

Midspan Clearance—Clearances at midspan necessary to prevent a flashover there* are presented in Fig. 2. A choice of four sets of curves corresponding to lightning potentials of 5,000, 10,000, 15,000, 20,000 kv. is afforded. These are the voltages assumed to appear on the ground wire itself and are not the traveling wave voltages in the lightning stroke. On this basis the surge impedance of the stroke itself is of no consequence, nor need we concern ourselves with the question of the mechanism of a lightning discharge. For each assumed lightning voltage there are three curves corresponding to heights of the line conductor of $h = 50$, 100, 150 ft. above the "true" zero potential plane. There is no such thing as a "true" ground plane common to both the electrostatic and electromagnetic fields.† Nevertheless it is convenient to make use of such a concept in an empirical sense, as the calculations are much simpler than those associated with the multi-velocity theory.

The only condition under which cognizance must be taken of the more complicated theory is in connection with the theory of the counterpoise. The greater the ground resistivity the greater the depth of the equivalent "true" ground plane. Pending a rational determination of this depth as function of the ground resistivity it is suggested that the $h = 100$ curves be tentatively used for comparative calculations. In any event, the error involved is far less than any guess which present information permits us to make concerning the magnitude of the lightning voltage. Intersecting the curves of voltage between the ground wire and the line conductor are five point-gap sparkover characteristics for time lags of 0.25, 0.50, 1.0, 1.5, 2.0 microseconds, which correspond to spans between towers of 250, 500, 1,000, 1,500, 2,000 ft. respectively. The proper clearance for the ground

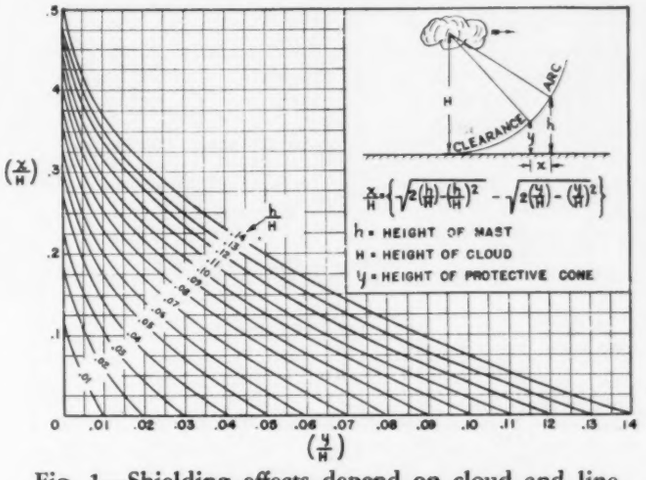


Fig. 1—Shielding effects depend on cloud and line height and wire separation

Example—What should be the height of a centrally located direct hit wire to protect three line wires in a horizontal plane at 25 ft. spacing and 60 ft. height against direct strokes from clouds higher than 1,000 ft.?

$x = 25$	$x/H = 0.025$
$y = 60$	$y/H = 0.060$
$H = 1000$.	$h/H = 0.070$ from curve $h = 70$ ft.

Thus a direct hit wire 10 ft. above the line conductors will just shield them from direct strokes. However, an extra 5 ft. elevation is advisable as a margin of certainty.

*See "Critique of Ground Wire Theory," by L. V. Bewley, A.I.E.E. Transactions, Vol. 49, March, 1931.

†See "Attenuation and Distortion of Waves," by L. V. Bowley, "Electrical Engineering," December, 1933.

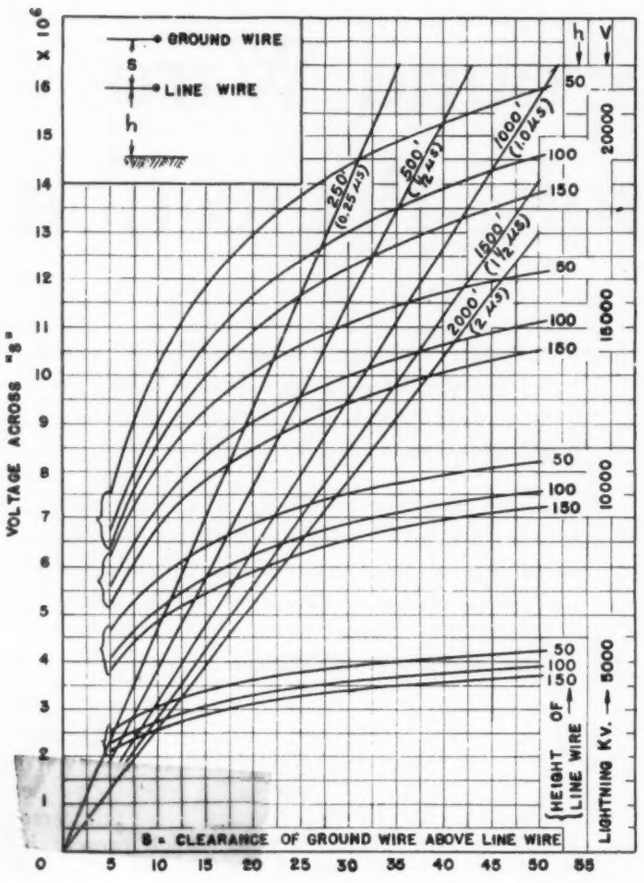
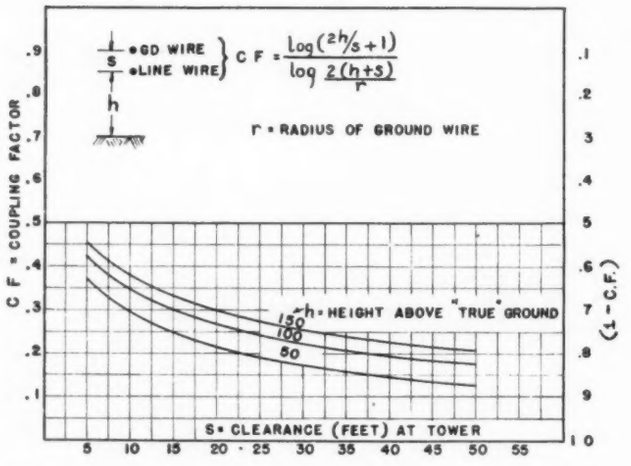


Fig. 2—Midspan clearance of ground wire hinges on span length.

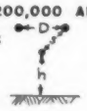
As an example, assume 15,000 kv. lightning voltage, $h = 100$ ft., and 1,000-ft. spans. The curves intersect at $s = 32$ ft. and the surge voltage across this gap will be 10,200 kv. These curves take into consideration the increased coupling due to corona.


GD WIRE
LINE WIRE
s
h
C F = log(2h/s + 1) / log 2(h+s)/r
r = RADIUS OF GROUND WIRE
C F = COUPLING FACTOR
(1 - C.F.)
h = HEIGHT ABOVE "TRUE" GROUND
S = CLEARANCE (FEET) AT TOWER

NO. OF INSUL. UNITS	LENGTH OF SPAN (FEET)					
	250	500'	750'	1000'	1500'	2000'
2	450	380	330	300	270	245
4	730	630	570	530	490	460
6	980	860	790	750	690	660
8	1250	1100	1030	970	900	850
10	1500	1340	1240	1180	1100	1050
12	1760	1580	1470	1400	1300	1250
14	2040	1810	1700	1620	1510	1440
16	2300	2070	1930	1830	1710	1640
18	2550	2300	2150	2050	1910	1840
20						

TOWER FOOTING RESISTANCE: $R = \frac{1000 \text{ Kv.(INSUL.) FROM ABOVE TABLE}}{\text{(TOWER CURRENT)}\ (1 - \text{C.F.})} \simeq \frac{\text{Kv.}}{150}$

ASSUME "TOWER CURRENT" OF 200,000 AMPERES

IF THERE ARE 2 GROUND WIRES:  $\text{C.F.} \simeq \frac{\log (2h/s + 1)}{\log \frac{2(h+s)}{\sqrt{rD}}}$

wire above the line conductors is simply the value of "s" at which the appropriate time lag characteristic intersects the chosen voltage curve.

Tower-Footing Resistance—The voltage appearing at the top of a tower struck by lightning is practically equal to the (RI) drop of the lightning current in the tower-footing resistance, provided that the wave front is several times the height of the tower. Supposing a severe lightning surge to have a front of one microsecond or more and a tower of 100 ft. height, there is ample time for the surge impedance of the tower to be eliminated before the crest of the surge is reached, and therefore the tower-footing resistance governs the voltage appearing on the top of the tower and on any connected ground wire. This resistance is not entirely constant, but appears to be a function of the applied voltage and to have an associated time lag. Pending more definite information concerning its nature it is suggested that the footing resistance used in calculations be taken equal to the resistance as measured by a megger or other low-voltage method.

In general,‡ there are three advantages to low tower-footing resistances: (1) Reduced voltage across the insulators, on the ground wire and on the line conductors; (2) limitation of the region of disturbance to a few spans; (3) shorter duration of surge voltages.

A formula for calculating the tower-footing resistance to prevent an insulator flashover appears in Fig. 3. It is:

$$R = \frac{\text{(Permissible voltage across insulators)}}{\text{(Tower surge current)}\ (1 - \text{Coupling factor})}$$

The permissible voltage across the insulators is fixed by their sparkover characteristic for a time lag equal to the time it takes the reflection to return from adjacent towers. The tabulation of Fig. 3 gives the permissible voltage for spans of 250, 500, 750, 1,000, 1,500, 2,000 ft. and for insulators of from two to eighteen units. The coupling factor is, by definition:

$$C.F. = \frac{\text{Voltage on line conductors}}{\text{Voltage on ground wire}}$$

This factor depends upon the heights of the ground and line wires, the separation between them, the radius of the ground wire and the presence of corona. Curves for this factor are given in Fig. 3, but for practical estimating purposes it may be taken as 0.25. The surge current in the tower as measured in the field has not so far been found to be higher than 200,000 amp. Using this figure as ultra-conservative, and 25 per cent cou-

‡*See "Traveling Waves on Transmission Systems" (a book), by L. V. Bewley, John Wiley & Sons, Inc.*

Fig. 3—Power-footing resistance should be 1/150 of permissible kilovoltage across insulators

pling, the necessary tower-footing resistance should be approximately

$$R = \frac{\text{(Permissible kv. across insulators)}}{150}$$

This calls for resistance of the order of 5 to 15 ohms.

If the tower-footing resistance cannot be sufficiently lowered by the use of either driven grounds or grids, then a counterpoise should be installed. This may be either a "parallel" (i.e., from tower to tower) or a "radial" (usually four lengths at right angles) type. A double parallel counterpoise may be the most efficient. Regardless of type, the separate wires should be at least 200 to 300 ft. long to obtain the most efficient results. A counterpoise has three recognized effects: (1) Its surge impedance, effective initially; (2) its leakage resistance, effective after several microseconds, and (3) its coupling with the line conductors, which raises the voltage on the line wires and thus decreases that across the insulators. The analysis is rather complicated and too involved to be gone into here.§

Station Protection—Sometimes a ground wire is installed to protect a station against direct strokes. In that event it should extend out far enough so that surges originating beyond its zone will attenuate below the station insulation level, allowing for reflection. In accordance with the Foust & Menger attenuation formula, the necessary distance (in miles) is

$$x = \frac{a\,(E/e) - 1}{K\,E}$$

where:

E = Voltage of surge entering ground wire zone, as fixed by line gap or insulator sparkover. For an assumed rate or rise of the lightning voltage, the magnitude and time lag of this chopped wave of triangular shape may be found on the sparkover characteristic of the line gap or insulators.

e = Voltage level to be protected at the station. This may be taken as the station gap at 2 or 3 microseconds time lag.

K = Attenuation constant. For short chopped waves it may be taken as 0.0003 to 0.0006.

a = Reflection factor at the station, depending upon the localized station capacitance and the wave shape. The wave will be elongated and rounded off. The following factors based on the station capacitance C (if concentrated) are good enough for comparative estimates:

C	0.0000	0.0002	0.0005	0.001	0.002	0.003	0.005
a	2.00	1.95	1.80	1.50	1.15	0.90	0.60

As an example, consider a 138-kv. system having ten unit insulators. There is to be no other line gap. The station insulation level is approximately (using an impulse ratio of 2):

$$e = 3.46 \times \frac{138}{1.73} \times 1.414 \times 2 = 780 \text{ kv. at 3 microseconds.}$$

Assuming that the line insulators sparkover at 0.25 microseconds time lag, the initial surge voltage is approximately $E = 1{,}700$ kv. If $K = 0.0006$ and the station capacitance is $C = 0.001$ mfd., then $a = 1.50$, and

$$x = \frac{1.5\ (1{,}700/780) - 1}{0.0006 \times 1{,}700} = 2.2 \text{ miles}$$

The above calculation assumes that there is no lightning arrester. But if a modern lightning arrester is installed, the ground wire extension is governed by the following criterion:

$$X = \frac{1}{2}\,(\text{Time lag of line gap}) = \frac{1{,}000T}{2} \text{ feet.}$$

This condition insures that the surge impedance of the intervening length of line conductor will not be eliminated by successive reflections during the time that the lightning arrester is subjected to the surge. Even allowing for 4 microseconds time lag, only 2,000 ft. of ground wire is necessary. It is absolutely necessary in such an installation to keep the tower-footing resistances low over the ground wire section.

§*See "The Counterpoise," by L. V. Bewley, G. E. Review, February, 1934.*

Transformer Failures Cut by Better Maintenance

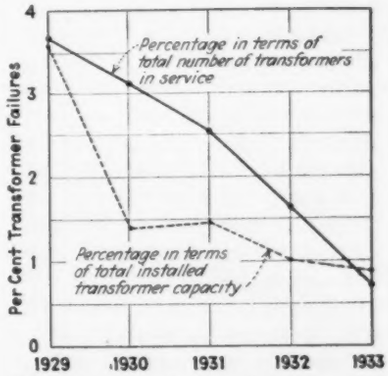
By L. M. SHADGETT
Superintendent Wholesale Operation, Georgia Power Company

Maintenance of transformers and adequate attention to protection are effective aids in reducing power transformer failures. In 1933 out of 2,896 power transformers of all ages 6.6 kv. and above, aggregating 1,618,940 kva., only 21 failures were experienced, or less than three-fourths of 1 per cent. The five-year average from 1929 to 1933 was 2.22 per cent in numbers and 1.52 per cent of the kva., showing the splendid performance in 1933. In the kva. item of 1933 one large transformer failure accounted for 8,000 kva., whereas the 16,351 kva. in failures of 1932 included no transformer larger than 3,333 kva.

In 1933 the average age of these transformers was eleven years, therefore an increase in the percentage of failures might be expected because of the increase in age. That this did not occur is undoubtedly due largely to better maintenance of the transformers and to better and more adequately applied protective equipment. A considerable use of fixed protective gaps set about 60 per cent below line insulation values undoubtedly aided in giving the splendid record of performance in 1933.

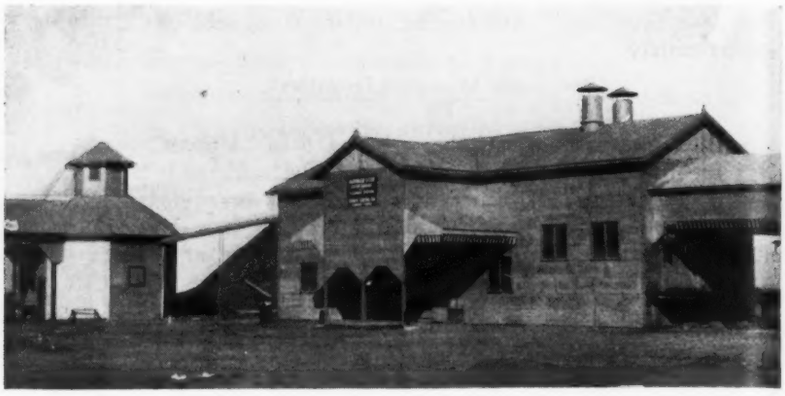
Record of Power Transformer Failures on the Georgia Power Company System, 6.6 Kv. and Above

Year	Transformers in Service		Failures		Per Cent Failing—In Terms of	
	Number	Total Kva.	Number	Total Kva.	Number	Total Kva.
1929	1,952	1,023,132	72	36,688	3.68	3.58
1930	2,499	1,471,837	78	20,726	3.12	1.40
1931	2,833	1,589,952	72	23,455	2.54	1.47
1932	2,868	1,604,080	47	16,351	1.64	1.02
1933	2,896	1,618,940	21	14,349	0.72	0.89
5-Year average	2,610	1,461,588	58	22,314	2.22	1.52



Better protection and more adequate maintenance methods reduce transformer failures

By T. V. GRAYSON
Rate Engineer
West Texas Utilities Company, Abilene



Watt-Hours Cheaper than Burrs as

Ginning a bale of cotton takes from 18 to 30 kw.-hr., average nearer 20, during the eleven to fifteen minutes required for the process, the shorter time being more advantageous. Power consumption of the fans can often be reduced merely by slowing them down, and this without detriment to the functioning of the gin.

Zero-cost fuel, in the shape of burrs from "bollie" cotton, can frequently be hauled away at less cost than burning it for steam generation, electric power thus being cheaper in the face of free fuel.

ELECTRIC utilities serving the South's cotton-producing area derive considerable revenue from the sale of electricity to cotton gins, although it has only been within the last decade that many power companies have attempted to secure this load, as prior to that time facilities to render service were not generally available. It is estimated that even now less than 25 per cent of gins use electric power and in the southwestern geographic division alone there is still better than 400,000 hp. in gin load that is being driven with competitive power.

Until this past year the cotton ginning business was one of the nation's few industries that did not have its output curbed by the depression (government cotton acreage reduction plan cut the 1933 production). Consequently, all classes of power salesmen have been working this field rather steadily during the past few depression years and every season sees quite a number of gins change from one form of power to another. Where a competitive electric rate is available the gin operator's decision usually depends on the ability of one or another of the various sales representatives to convince him of the superiority of the type of power he offers.

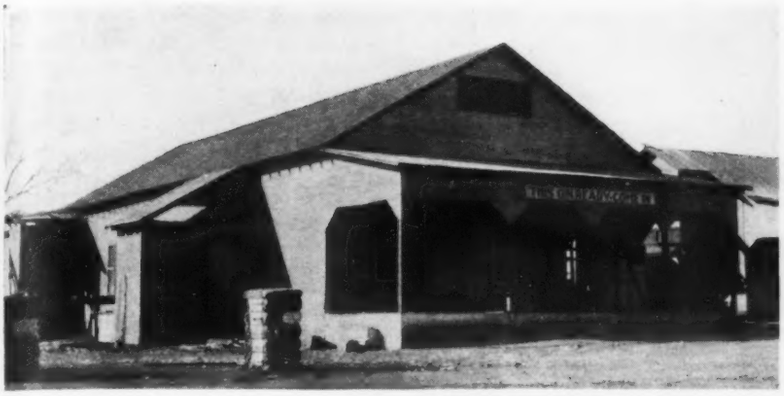
Like the electric utilities, ginners stress service to their customers and the equipment giving the least interruptions frequently determines the selection. A number of operators use electric power because it enables them to start early and gin late in the season, at which times only a few bales per day are ginned and such small volume would not justify keeping the gin open with steam and some other power due to fuel and labor costs. Three or four men are able to operate an electric gin, but this number would be insufficient if the plant used another form of power. Another factor favoring electric service is that motor trouble can be quickly remedied by substitution, whereas a boiler or engine repair may take from two days to a week, in which period up to 15 to 20 per cent of the entire season's business may be lost, depending upon the time of season the failure occurs.

Electrical first cost low

The low first cost of electric equipment compared with reliable competitive forms of power often causes the ginner to electrify his plant. Shutdowns in other industries during the past few years have made available an abundance of used motors at ridiculously low prices. This is a real consideration with some prospects as the gin operator can often buy and install a 75 to 100 hp. motor capable of giving first class service for less than $600, and the difference in fixed charges on this figure and a $4,000 to $8,000 competitive power plant certainly causes thought to be given electric service. One utility company in the Southwest has electrified about eighteen gins during the past two years and not one of these plants bought new motor equipment. Many ginners, however, do not attach proper importance to fixed charges. We often hear operators make the statement in utmost sincerity that their average power cost is 20 cents per bale with an oil engine, when in reality this figure includes only fuel and lubricating oil cost, and when extra labor, maintenance and fixed charges are considered the actual cost may be around $1 per bale, depending upon the volume of business.

Electricity cheaper than free fuel

Where a considerable amount of "bollie" or "snap" cotton is ginned the burrs separated from the cotton will supply sufficient fuel to operate a steam plant. Under this condition the power salesman must determine whether or not the additional labor and fixed charges



Diverse types of gin structures

Both of these are four-stand, air-blast gins. But the smaller building contains motors totaling 145 hp. and the larger only 120 hp.

Cotton Gin Power

involved offset the saving made in fuel cost and then convince the ginner that even with free fuel electric power will result in a lower over-all cost. In many instances the operator can actually hire trucks to haul away the burrs from his gin and still save money operating with electric power against a steam plant. The cost of power for electric gins varies considerably between different plants and also between various sections of the cotton-producing South. For example, in West Texas the type of cotton grown does not have a very large stalk and, with no little protection, frequent winds fill the stape with dirt and trash, which necessitates more elaborate cleaning equipment and slower ginning, with consequent higher energy used per bale output. Again, when the price of cotton is low or picking labor scarce, there is a tendency in some sections to pull or sled the burr and cotton together instead of picking, and it often requires as high as 20 per cent more energy to gin "snap" or "bollie" cotton than would be used with picked cotton.

The efficiency of the gin plant itself is another factor affecting power cost, the type, age and condition of the equipment being involved. Some plants, because of the above limitations, must necessarily gin slowly in order to turn out the proper lint recovery, while others perform a satisfactory job ginning fast. The average fairly efficient gin should use between 20 and 25 kw.-hr. per bale, although some plants go lower than 17 kw.-hr. and others higher than 33 kw.-hr.

Probably the most important factor affecting power cost is the ginner's judgment regarding the minimum time that his plant should take to gin out a satisfactory bale, as slow ginning can result in an excessive energy consumption. The speed of gin machinery is practically constant; i.e., all equipment is operated at the same rate of speed whether the output is two or four bales per hour, the rate of ginning being controlled by the amount of cotton released from the feeders into the gin stands and not by changing the r.p.m. of the stands, fans, cleaners, etc.

The fans, when operating, require about the same amount of power, regardless of whether or not the air handled is being utilized for actual ginning purposes, and the amount of cotton handled by the machinery does not materially increase the power load of the other equipment as only a small volume of the total is handled by the cleaners, feeders and stands at one time. Therefore, with the load remaining practically constant, the kilowatt-hour use per bale ginned depends primarily upon the amount of time consumed in passing the bale through the gin.

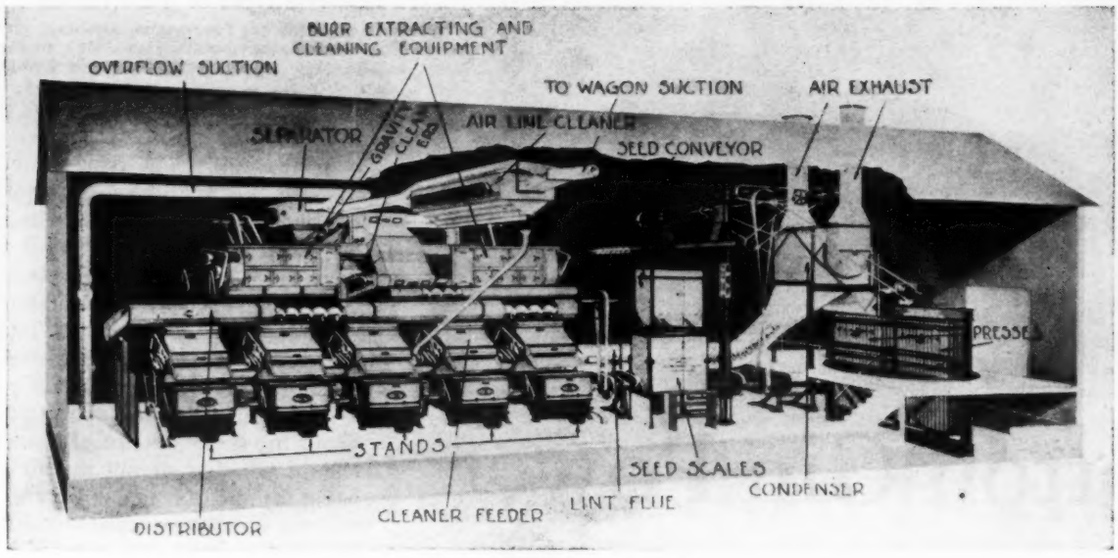
Table I shows the results of tests made on three gins this season and a study of this tabulation clearly establishes the fact that power costs vary directly with the bale per hour output. Note that the minimum time taken on gin "C" was 11 minutes 6 seconds and during this period a bale was ginned with an energy use of 18.8 kw.-hr., the average load being 101.62 kw., while the maximum time was 15 minutes 40 seconds and 25.5 kw.-hr. was required to gin this bale, the average load during this period being 97.28 kw. In other words, with a 41 per cent increase in ginning time the average load was decreased only 4.27 per cent, while the energy consumption was increased 35 per cent. All of the tabulated data were taken while square bales were being ginned.

Fan power can be saved

Next to slow ginning improper operation of air-blast fans will account for most excessive energy uses per bale ginned. Where a fan is moving more air than necessary power is being wasted, and as the volume of air required

Plenty of waste fuel

Some of the burrs separated from cotton by an electric gin during four months operation. Although the above material has more than sufficient fuel value to operate a steam plant for an entire ginning season, this cotton gin finds operation with electric power cheaper even with free boiler fuel available.



How a cotton gin works

A pneumatic unloader, ordinarily composed of 12-in. pipe flexibly jointed and arranged telescopically, connected to a 35- to 40-in. diameter suction fan operating from 1,700 to 2,200 r.p.m., sucks the cotton up out of the farmer's wagon and conveys it to the separator and cleaning equipment. Then either a spiked-belt or screw-type distributor carries it to the feeders, which are located over the gin stands. The rate of ginning is controlled by adjusters on the feeders, which can be varied so that cotton is released to the stands at various rates.

After the feeders deliver the cotton to the gin stands picker rolls in these machines eliminate any trash that may have come this far and two sets of metal ribs, in conjunction with circular revolving saws, separate the cotton lint from the seed. As the cotton lint is carried through the smaller set of ribs on the saw teeth it is swept off, either by a blast of air emerging from nozzles set behind the saws or by brushes set on a circular revolving drum, according to whether the gin stands are of the air-blast or brush type, and after leaving the saw the lint is carried on to the condenser through a metal flue by air. At the condenser the lint and air are separated by a revolving screen cylinder, the air passing out of the building through a flue and the cotton being discharged into a press box.

The conventional square bale press usually consists of an automatic packer and two timber boxes mounted on a round table for 180 deg. rotation in such manner that during ginning one box is being filled with cotton while the previous bale is being pressed up with a hydraulic pump, after which the press box sides are released and the bale "tied out" with flat steel ties and bagging covering. The seed which was separated from the line in the gin stands is screw-conveyed out of the stands and thence to storage.

The size and number of gin stands installed determine the bales per hour output of the gin, with all other things being equal as to efficiency, etc. Cotton gins ordinarily vary from three to seven stands, with four and five stand gins predominating. Obviously, the operation of the above equipment may be accomplished with any form of prime-mover capable of delivering the required power, which usually varies from 75 hp. in the smaller plants up to as much as 180 hp. in the large gins.

in a gin is practically constant, the blast fans should be adjusted to move the amount of air needed and no more. The horsepower input to a blast fan will vary with its speed, the size of the intake orifice and the static pressure operated against, conditions which should be adjusted to overcome only the correct resistance instead of allowing the fan to draw excessive power by improper operation. Quite often the speed of a fan can be lowered and the horsepower input to the particular unit reduced from 20 to 50 per cent without impairing the efficiency of the gin plant in the least. All line shaft speeds should be carefully checked in gins that appear to draw excessive power and no piece of machinery should be operated at a higher speed than is necessary. Table II illustrates the savings made in power consumptions of several gin plants recently by changing the speed of the equipment.

As stated earlier, there is a considerable amount of gin load available for the power companies where they desire it, as probably few utilities serve as many as 10 per cent of the gins that they might. The peak of this

Table I—Times and Energy Consumptions for Cotton Ginning

Plant	Ginning Time per Bale Minutes	Seconds	Kw.-Hr. Used per Bale
Gin "A" Four 70-saw stands, air-blast type, 100 hp. connected	16	15	16.65
	17	0	17.70
	17	15	17.40
	18	30	17.10
	18	40	19.10
	19	20	20.00
Gin "B" Four 80-saw stands, air-blast type, 110 hp. connected (This gin was having trouble with its feeders when test was made.)	15	40	19.84
	17	56	22.42
	18	2	24.04
	18	36	24.80
	19	43	26.29
	20	19	26.41
	23	8	30.46
Gin "C" Five 80-saw stands, air-blast type, 135 hp. connected	11	6	18.80
	11	58	18.10
	12	0	19.20
	12	12	19.80
	13	15	19.80
	13	45	22.50
	14	30	22.50
	15	34	24.00
	15	35	24.80
	15	40	25.40

Table II—Power Saved by Reducing Gin Speeds

Plant	Nature of Change	Average Kw. Load Before Change	After Change	Per Cent Saving in Power
Gin "D" Five 80-saw stands, air-blast type, 110 hp. connected.	Speed suction fan lowered 1,980 to 1,850 r.p.m. Blast fan speed changed 2,000 to 1,800 r.p.m.	91	80	12
Gin "E" Four 70-saw stands, air-blast type, 100 hp. connected.	Speed of both suction and blast fans lowered from 2,440 to 1,950 r.p.m.	76	60	21
Gin "F" Five 80-saw stands, air-blast type.	Speed of suction fan lowered from 2,260 to 1,950 r.p.m.	89	78	12

load, however, is simultaneous with the yearly system peak of some electric companies and studies should be made in order to avoid increasing the system peak out of proportion to the benefits derived. Plants contiguous to existing service facilities and with a good volume of business should be sought and powered as much as possible with primary motors.

The rates offered should be low enough to attract the business and still cover proper costs. As to the type of rate, many utility companies prefer to use an energy charge form of schedule for this class of load, while on the other hand one company, at least, has been very successful in building gin load with a demand rate based on the installed horsepower. Such rate facilitates collections and eliminates the necessity of going back on the gin operator for the difference between his billing and the minimum guarantee where a plant does not operate enough to absorb minimum charges. The demand schedule is designed in such a manner that the annual guarantee is collected during the first three months operation of each ginning season.

Heated Floor Slab Protects Storage Areas

Moisture, the eternal foe of office records, and chill, as discourager of efficient, intermittent filing, have been economically banished in one storeroom

By H. T. CRANE
Engineering Department, Southern California Edison Company, Ltd.

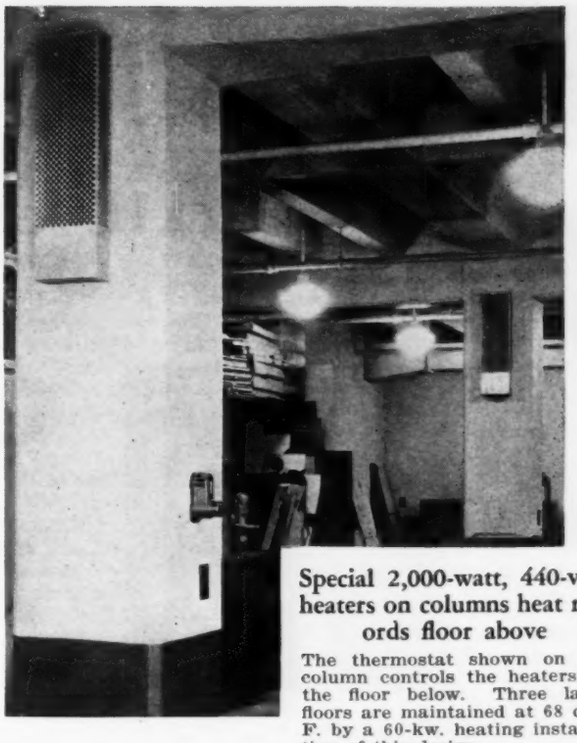
In a six-story annex to the Southern California Edison Building in Los Angeles the lower floors are used as storage space for company cars and the upper three floors are devoted to the storage of records of the company. No heat is provided in the garage section of the building, but the 15 kw. of lighting on each of the floors will aid considerably in taking off the chill. Various individual offices and studios in this section are heated by standard flush-type 220-volt electric heaters.

In the record storage areas, which are fairly large and in which people work intermittently for short periods of time, it was felt that the only practical way to provide heating was to keep a constant temperature of about 68 deg. It was also desirable to have a type of heat that would penetrate the aisles of filing cases to keep out moisture from the records.

To maintain a constant heat of 68 deg. it was decided to warm the floor slab and use it as a source of heat. Heating units, hereinafter described, were installed near the ceiling of the floor below and a blanket of warm air spread underneath the floor slab. Twenty kilowatts, or about 0.25 kw. per cubic foot, is installed for heating each of the three record storage floors.

Five 2-kw., 440-volt heaters are on each circuit. A six-circuit flush distribution panel with a 30-amp., two-pole fuse switch and a 440-volt, two-pole contactor on each branch is conveniently located on each floor. Contactors are controlled by thermostats installed centrally in the heated area.

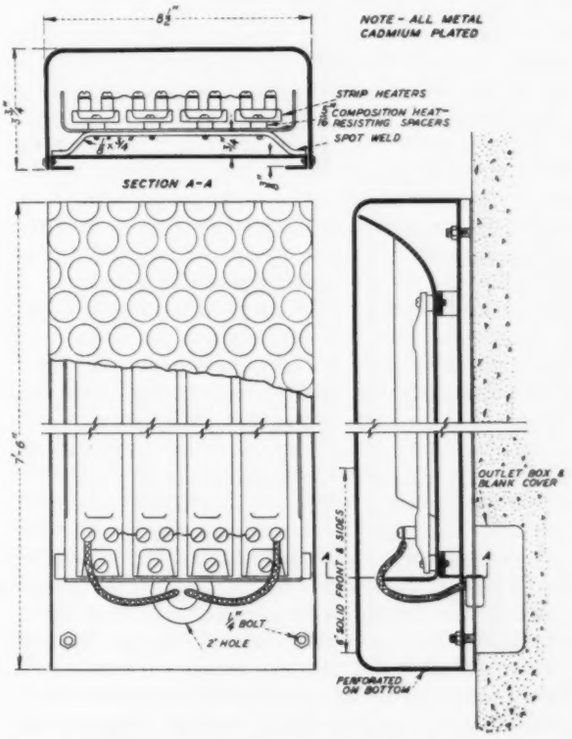
As it was desirable to keep the heat under the central portion of the floor slab the heaters were mounted on columns of the floor below approximately 7½ ft. above the floor. A special inexpensive heating unit was developed for this purpose.



Special 2,000-watt, 440-volt heaters on columns heat records floor above

The thermostat shown on the column controls the heaters on the floor below. Three large floors are maintained at 68 deg. F. by a 60-kw. heating installation of this design.

This heating unit consists of four 500-watt, 110-volt standard strip elements wired in series and inclosed in a suitable middle housing. Designed and built locally, the simplicity of these units, together with the inexpensive wiring and control, makes the installation of this 60 kw. of heating capacity extremely economical and exceptionally efficient for the type of heating needed.



Strip heating unit warms the floor slab from below

Plan Now for Desirable Air-Conditioning Load

By R. E. HELLMUND
Chief Engineer Westinghouse Electric & Manufacturing Company

So little has been done about air conditioning and so much vaguely said about it that it has scarcely worried the distribution engineer much.

If, contends Mr. Hellmund, this service can be rendered satisfactorily at a reasonable cost and if it has the proper economic and technical characteristics it will be a profitable and successful utility load. It has both.

So, distribution facilities will have to be revamped to meet the needs of the service. Now is the time to start.

AIR CONDITIONING will develop into a profitable and successful electric load only if it reliably performs a desired service at a reasonable cost and if, in addition, it has the proper economic and technical attributes as far as the power system is concerned. For the moment, much of the discussion is on the possibilities of its commercial exploitation, on the relative technical merit of the air-conditioning equipments and on the principles upon which they function. Just as was the case with the domestic refrigerator, the equipment will have to be reliable, operate for long periods without attention, be quiet, cheap, efficient and interfere negligibly with existing quality of service rendered from utility systems. But air conditioning represents a much larger load for the utilities, and therefore is fraught with consequences that can be detrimental to service unless the supply system and the air-conditioning units undergo co-ordination that moves hand in hand with the development of the market. Without any doubt, air conditioning has unlimited possibilities both as a potential business for the manufacturers and as a load builder for the utilities.

The statements frequently made to the effect that the total potential business along this line may run not only into millions but into billions of dollars and that several millions may be spent for such equipment in cities like Chicago within the next few years are by no means exaggerated. When we size up the market for an item such as the domestic refrigerator we are generally limited to a certain percentage of the 20,000,000 homes, and yet this business is quite appreciable. In the case of air conditioning the same number of homes represent a market for either a central system or for several room coolers each. In addition, business establishments, such as restaurants, barber shops, stores, mortuaries and many others, represent very large potential markets. The vast number of offices in our great cities and in industry represent another broad market for room coolers and condensing units, especially in structures already existing. While the loads of refrigerators range in fractions of a kilowatt per unit, cooling units for air conditioning represent loads from 1 to 20 kw.

Public will buy when costs are right

There is every reason in the world for believing that this same human race which has for the past decade expended every effort possible in eliminating the heavy burden of labor, both in industry and in the home, will just as willingly direct its attention toward comfort as the next step if such comfort can be brought within the reach of many of them. The present rather high first cost and operating cost of cooling equipment will be only a temporary handicap. Costs will be reduced and there is no reason why in normal times the public, which in the past has spent hundreds of dollars for washing machines, refrigerators and similar devices, and which has carried appreciable expenses for owning and operating automobiles, will not be willing to spend similar amounts for comfort and health, especially during the hot summer months.

AS A natural result of such possibilities the question is raised as to whether air conditioning will be a desirable load for the utilities. If by "desirable" load is meant one which with the proper effort and ingenuity on the part of the engineers can be made to yield a fair and reasonable profit, such a question is reasonable and deserves serious consideration. On the other hand, if a "desirable" load should be construed as meaning one that has all of the most desirable characteristics, such as a high load factor, high power factor, absence of any disturbance in the line, and the

like, and which therefore could very readily be connected to existing systems and yield large profits without presenting any problems at all, the question hardly deserves to be taken seriously.

Equipment costly for ideal load characteristics

Perhaps this point can best be illustrated by a brief outline of the type of equipment which, according to conventional ideas, has all the earmarks of a desirable load from the power system point of view. It so happens that the daily load factor of the electromechanical cooling system is reasonably good—at least as good as that of the majority of existing loads, and possibly better. On the other hand, the yearly load factor is not very good, because for the present we are primarily concerned with summer cooling systems; however, it can be made so by insisting that the equipment be provided with features for reversed refrigeration for heating and that it be used for both cooling and heating purposes.

In order to avoid disturbances in the system, it is of course desirable to avoid frequent starting and stopping of the relatively large motors involved. This can be accomplished with an adjustable-speed motor running more or less continuously and with its speed regulated to take care of the varying load resulting from constantly changing weather conditions. An a.c. commutator motor with an automatic brush-shifting arrangement, or possibly a d.c. motor operated by means of electronic devices from an a.c. system could be built for this purpose. These motors could be arranged to have power-factor compensation and low starting current. It is furthermore possible to provide such motors with filtering equipment for the elimination of radio or telephone interference. This, in brief, indicates the possbilities of an arrangement which is ideal with regard to the power system because it has good load factor and power factor, no disturbances in the power system from starting currents and no radio interference. The design engineers, who are always eager to solve intricate problems, would most likely delight in evolving such an arrangement.

Compromises necessary

Unfortunately, however, there is just one thing wrong with such equipments, and that is that in all probability very few of them would be sold, and consequently there would be no worth-while air-conditioning load for either the utilities or the manufacturers. The reasons for this are many. In the first place, the cost of this equipment would be so high that it in itself would prevent many sales. Furthermore, the power consumption, and therefore the operating costs, would be very high because the equipment, which would have to be large enough to take care of extreme temperatures, would operate most of the time with low loads and therefore at very low efficiency. This again would be sufficient to prevent any appreciable number of applications. In addition, the cost of heating with such a system would make it non-competitive with other methods of heating under many climatic conditions. Finally, it is evident that the maintenance and complications with commutator motors or arrangements with electronic devices would lead to equipment which would be unreliable and costly to maintain.

It is thus evident that this "ideal load" solution, which is quite feasible from a purely technical point of view, is not the one to be adopted. On the contrary, both manufacturers and utilities in attacking this new problem might just as well realize at the very beginning that if they wish to create a broad and appreciable market for themselves in the near future they must expect to solve new problems, and that in so doing they must adopt a most liberal point of view, unhampered by conventional ideas and practices.

Some of the salient points which should be thoroughly appreciated are as follows:

1. The first cost of air-conditioning equipment, even at its best, is at present, and will be for some time to come, higher than that which the users can conveniently afford to pay for this purpose. Therefore, all possible efforts must be made to furnish equipment at the very lowest cost.
2. The operating costs of cooling equipment also are greater than the users can conveniently afford, and therefore every effort must be made to reduce these costs to the minimum.
3. The application and maintenance conditions in connection with this air-conditioned equipment will be less favorable than is the case with other motor equipment of the same size. Since by far the largest number of applications during the next few years will have to be made in existing buildings, many of the equipments will be located in very inaccessible places and frequently where there is no skilled maintenance personnel. It is therefore imperative that the type of equipment chosen be of the simplest type possible, with all gadgets and complications omitted which are not absolutely essential.
4. The more general introduction of air-conditioning equipment into various business and domestic living quarters means that an appreciable amount of power will be required in many localities where the loads at present are rather light. Therefore, ways and means will have to be found to supply this greater amount of power at a minimum expense.

More polyphase circuits to be provided

THERE is no question that the first three conditions enumerated can be met by a simple three-phase, squirrel-cage induction motor starting directly across the line. For ratings of 5 hp. and above there is, of course, little doubt as to the use of polyphase power; however, the utilities should seriously consider whether it would not be advisable to furnish polyphase power even for the lower ratings, at least in those districts where there is reasonable promise of a more extensive use of air-conditioning equipment. Since the squirrel-cage motor does not permit speed adjustment, it will be necessary to take care of the varying load by starting and stopping the equipment and running it for varying periods of time, the same as is now done with refrigerators. This, of course, means that rather large starting currents, with consequent tendency toward voltage drops, will have to be contended with and that ways and means will have to be devised for obtaining satisfactory line regulation; in many cases a suitable network system may have to be considered. In business districts similar loads, such as those created by commercial refrigeration, will have to be considered as part of the picture.

While a three-phase system seems to offer the best solution in many cases, it must be kept in mind that there will be certain localities where the supply of three-phase power would be uneconomical. Therefore, equipment that can be operated by single-phase power must be available, at least for ratings below 5 hp.; either single-phase capacitor motors or repulsion-start, induction-run motors can be considered for this purpose. These at present are the simplest known types of motors, although neither of them is as desirable as a polyphase motor. In the capacitor motor equipment the motor

proper is most simple and rugged, but slight complications in the control are necessary. In the case of the repulsion-start, induction-run motor the control is simpler, but the motor is equipped with commutator and brushes, with their inherent maintenance difficulties, and in addition special filtering equipment for eliminating radio interference may be necessary in many places.

With either of the two equipments, adjustment to the varying loads has again to be accomplished by starting and stopping and running for varying periods of time. This naturally will create certain problems for the utilities in connection with the flickering of lights; nevertheless, a most liberal attitude on their part should be adopted with reference to starting current regulations. In many cases proper planning in the way of line regulation by the use of transformers with low reactances and similar means may give better all-round economy than the use of costly and complicated motor equipments with unreliable operation and high maintenance expense.

Power factor not likely to be a problem

MOTOR equipments previously mentioned are the ones which will result in minimum first cost. At the same time, the method of starting and stopping for the purpose of regulation means that the equipment while running is fully loaded and therefore operating at maximum efficiency; in other words, the power consumption and cost of operation are reduced to the minimum. For similar reasons, the power-factor conditions will be as favorable as can be obtained without the complication of special power-factor correcting means. With single-phase power the capacitor motor, although having somewhat larger starting currents, is of course the most advantageous with reference to power-factor conditions.

No mention has been made of direct-current equipment, but for most ratings it has been found necessary to have equipment available for d.c. operation to take care of downtown districts of certain cities; here again simple constant-speed motors with simple control are preferable.

The discussion so far has related essentially to equipments of 1-ton capacity and above, requiring motor ratings of 1½ hp. and above, and it has been frankly pointed out that these equipments as designed present certain new problems in the way of power supply. In addition to these equipments, there are certain self-contained coolers of ½-ton capacity for operation on alternating current only. The input of these equipments is less than 1 kw., and in general they can be connected the same as any plug-in device. In the large majority of cases the existing power supply will be sufficient to handle this load. The capacity of this small equipment is sufficient only for small rooms during day operation, but it is expected that extensive use of these small coolers will eventually be made in sleeping quarters. This application happens to be nearly ideal for the utilities because the load probably will be required between 9 and 1 o'clock at night and therefore will constitute practically an off-peak load for the system; in many cases the load may also occur after the peak of the distribution circuits. The annual power consumption for this application will be quite reasonable under most of the present-day rates, and the first cost may not appreciably exceed that of a large refrigerator.

With the main features and characteristics of equipments which give promise of an early application thus established, it is of course essential to determine next whether such equipments constitute a load which can be handled by the utilities at low cost and consequently at favorable rates. The mere fact that a certain type of load results in the consumption of a large number of kilowatt-hours as compared to other loads does not necessarily mean that a low rate is justified. For example, the heating of homes directly by electric energy would very materially increase the annual consumption per home. However, if we assume climatic conditions with but few very cold days during the year and rather moderate temperature during the remainder of the time, it is at once evident that under such conditions the cost of supplying power cannot be very low. Such a case would mean very high peak loads, necessitating extra investment for distribution and possibly for generating equipment which would be utilized very little during most of the year. Considerable extra investment would actually have to be made by the utilities because their present distribution system would as a rule not carry domestic heating loads in the order of 20 to 30 kw. for each of even a limited number of electrically heated homes.

Fortunately, the introduction of air conditioning with the present trends and conditions is in general not handicapped by such unfavorable conditions. By far the largest part of air-conditioning loads to be connected in the near future will be in business establishments such as restaurants, stores, beauty parlors, barber shops, offices, etc., all of which are located in business districts. The distribution circuits in these districts are as a rule such that they at least can take care of the initial installations of air-conditioning equipment, and it is needless to say that there is plenty of generating equipment available for handling an increased load.

Well to start program on partial basis

IN MANY residential districts the installation of equipment for air cooling of entire homes would mean immediate and complete revision of the distribution circuits. However, there is one thing which will bring about this development rather gradually. Both the first cost and the operating cost for cooling an entire residence are at present so high that but few installations of this nature will be made in the near future; in fact, whenever as a result of the wide publicity which air conditioning has received inquiries are made regarding these costs by home owners, their interest dies out very quickly upon hearing the figures. For this reason, fairly definite efforts should be made to "unsell" this idea of completely cooling homes and to advocate in its place the idea that comfort can be greatly increased even by a limited amount of air conditioning. The public at large, if it cannot afford a whole loaf, will find a half loaf better than none. The previously mentioned idea of creating comfort during sleeping hours is an example of this. Again, the installation of something like a 2-ton (about 3-hp.) unit in a home which would require a 6-ton equipment for complete cooling will greatly add to the comfort of the occupants at a reasonable expense. If this equipment is arranged so that it can alternately cool different parts of the house during that part of the day when they are occupied, or else so as to give a moderate amount of cooling and dehumidification over the entire house, it is likely to be favorably received. An experimental house in Mansfield, Ohio, is at this time being

equipped with a 2-ton equipment and arranged for various optional uses of its cooling capacity. This house will be used by various occupants for different periods of time and some very desirable practical data along this line should be obtained.

Not too early to plan distribution revamping

WHILE development of such a trend for homes is again primarily for the purpose of furnishing the user with something he wants and can afford, it incidentally has definite advantages for the utilities. The individual equipment and its peak load can for the present be handled in a great many cases by existing distribution facilities. The conditions with regard to load factor and starting impulses will be very much improved because the equipment will operate continuously for many hours either for the purpose of conditioning the entire house as far as possible with the available capacity or for successively cooling various parts of the house during the time they are occupied.

From the foregoing, it thus appears that since many system loads are lower in summer than in winter and than the present available excess capacity, the early additional investments needed in the system for air conditioning will be limited to an occasional increase of distribution-line and transformer capacity called for either to handle the increased load or to improve the voltage regulation. However, there is little doubt that the partial use of air conditioning in homes and business establishments will eventually create a desire for complete air conditioning of homes and buildings, the fulfillment of which will in all probability become practicable as time goes on and as the cost of the equipment and power rates follow the usual downward trend. It is, therefore, not any too early for the utilities to lay out the groundwork for plans for handling such increased connected loads for air conditioning whenever they become a reality.

Radiation heating and reversed refrigeration

Naturally, as the existing power and distribution equipments become loaded, greater attention will have to be paid to the creation of year-round loads so as to bring about economical use of any new system equipment being installed. The increasing use of winter air-conditioning equipment, such as that for humidifying, filtering, etc., will increase the use of blowers and pumps for air and liquid circulation and thus create a certain winter load. In addition, there are a number of possibilities that can be developed as time goes on for the purpose of obtaining a more uniform load. In certain milder climates reversed refrigeration for heating purposes all through the winter will probably be developed to the point where it will be economical. Experimental houses having reversed refrigeration are now being operated, but many problems, especially with regard to the development of equipment sufficiently quiet for operation in the home, have to be solved before this method can be exploited commercially. In many instances, where more severe climatic conditions do not permit the use of reversed refrigeration for winter heating, it may be found desirable to use it for heating purposes during the spring and fall and thus limit the use of fuel-operated furnaces and the attendant inconveniences which are experienced in a few of the coldest winter months.

Furthermore, there exists even at this time, at least where the rates are favorable, an opportunity which in the past has not been exploited to full advantage, and that is the introduction of auxiliary electric heaters into homes for such places as bathrooms and fireplaces. As progress is made in the education of the public to appreciate the advantages of radiant heat, either in the form of portable screen heaters or of panel heaters built into the walls, additional winter loads will be developed and thus result in a more uniform load for air-conditioning purposes than can be obtained with summer cooling alone. This matter of radiant heat and the influence of the heat which radiates from the body to colder surrounding objects, such as outside walls, is perhaps at this time the least understood and appreciated. It is, however, an important factor in winter comfort, as very often cold which is felt while sitting near a wall is blamed on a draft when the discomfort actually is due to the radiation of body heat to the wall. A considerable amount of experimental research work is being carried on along this line, and the previously mentioned experimental house now being built in Mansfield, Ohio, will have one room equipped for testing this method of heating.

Steam jet cooling a formidable competitor

A REVIEW of air conditioning as a possible load builder for electric systems would not be complete without giving consideration to competitive non-electrical methods of air conditioning. As far as the motors needed for driving blowers for air circulation and pumps for the circulation of liquids are concerned, the electric motor is practically without competition. However, for air heating the various fuel-operated heating means are of course serious competitors. Electrical power can replace them only slowly, and in the beginning only under favorable conditions. Where rates are low and climatic conditions mild the reversed refrigerating cycle has a good chance as far as operating costs are concerned, but the initial cost will prove a serious obstacle unless the increased comfort that is obtained through summer cooling with the same equipment is the primary consideration.

The heating of entire houses directly with electric power will find application on account of its low first cost, where power rates are exceptionally low. In connection with air cooling, at present the electromechanical system has in most cases the economical advantage over the various fuel-operated systems, such as the steam-jet system and the absorption and adsorption systems. Nevertheless the latter systems may win out where the ratio of fuel costs to electric power rates is favorable, a fact which deserves serious attention in the setting of power rates. The one case in which the electric system is at present non-competitive with the steam-jet system is in larger installations, where steam systems are used for winter heating and the summer air conditioning thus represents an off-peak load for investments made necessary by the heating load.

In conclusion, it can be stated, from the facts as they now appear, that air conditioning can, with the proper effort and attitude, be developed so as to become an important and desirable load builder for electric systems; therefore, any efforts on the part of the utilities to promote and cultivate this activity will be very much worth while.

Advertising to Justify Rates

By A. B. WEST

President Southern Sierras Power Company, Riverside, Calif.

Nine important points to be stressed in informing public opinion on the relative cheapness of electric service

OUR company has found it effective to reproduce a chart in all of the newspapers in the territory served by it indicating that the cost of domestic electric service rates has not gone up, based upon statistics compiled by the United States Bureau of Labor, as has the cost of food and clothing. Instead, the general rates steadily declined and were still shown to be below these commodity prices with 1914 as an index base. This advertisement brought favorable comment from domestic consumers. Many of them realized for the first time that there was a power company side to the question of rates as well as the side of the consumers.

Recently our company was attacked in a certain municipality by advocates of a municipal Diesel-engine-generating plant, the argument being advanced that the proposed plant would reduce rates. An advertisement was published showing that the politicians of the city making this promise were not to be taken too seriously for the reason that the municipal water rates had been maintained at a 75 per cent higher rate than existed in 1916, for eleven years, while electricity for the domestic consumer was 6 per cent lower than it was in 1916. Another advertisement in the same campaign, to answer the complaint that rates have not been reduced, produced a chart showing that the average rate paid for electricity in the city had dropped 45 per cent in ten years, a fact that had not been realized by consumers, whose increased use of electric appliances had caused their monthly bills to be increased. This advertisement also resulted in many favorable comments from people who had previously favored the municipal program.

How to present the utility's case

Summing up the situation, it is suggested that in the advertisements used by power companies presenting their message on rates to the people the following facts be developed:

1. Show, preferably by curves, the actual reductions in rates that the company has made since 1914, comparing such reductions with the fluctuations in commodity prices for the same period. Up to the present date this comparison is entirely to the advantage of California power companies.

2. Present a graph that shows the changes in rate levels that have taken place, compared with the unit cost of government in the district served, and in the state of California. For example, per capita cost of state government increased from $72.86 in 1915 to $129.26 in 1931.

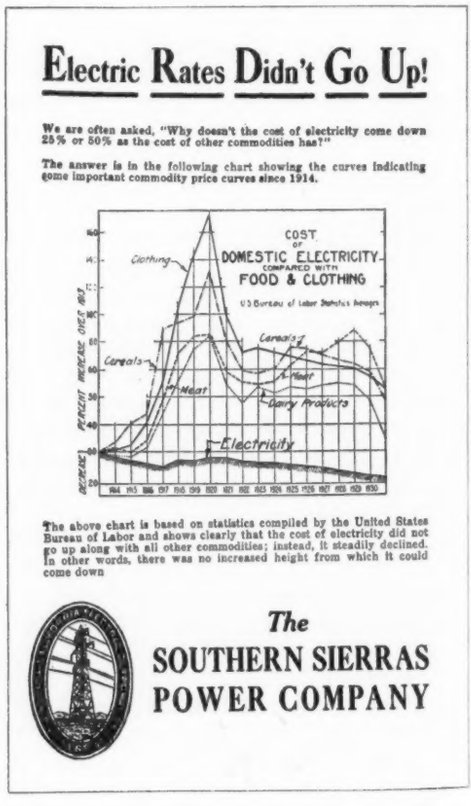
3. Compare by graphs the fluctuations in municipal water rates and electric rates since 1914. In many instances the water rates have been increased while electric rates have decreased.

4. California electric light and power companies had their rate of gross earnings taxes increased by 66.6 per cent in 1921, but rates were steadily reduced after that time, despite this heavy increase, and this may be set forth in the exact amounts of taxes that were paid by each company.

5. Residential consumers are steadily adding electrical appliances to their equipment. This has a natural tendency to increase the total amount of the monthly electric bills and is easily confused with rates. In other words, monthly bills may be considerably higher for the individual, while his rate may be lower than it formerly was. He understands this when he buys a barrel of sugar instead of a small package, but frequently is not familiar with the total amount of electricity that he uses.

6. The amount of electricity used in the home varies greatly according to the territory served. However, it is never more than a small percentage of the total household budget.

7. Develop the fact that, contrary to popular impression, both the gross and surplus earnings of the power companies have been largely reduced, the greatest losses having taken place during the last six months, presenting


Electric Rates Didn't Go Up!
We are often asked, "Why doesn't the cost of electricity come down 25% or 50% as the cost of other commodities has?"
The answer is in the following chart showing the curves indicating some important commodity price curves since 1914.
COST OF DOMESTIC ELECTRICITY COMPARED WITH FOOD & CLOTHING
U.S. Bureau of Labor Statistics Records
Clothing
Cereals
Meat
Dairy Products
Electricity
PERCENT INCREASE OVER 1913
PERCENT DECREASE
The above chart is based on statistics compiled by the United States Bureau of Labor and shows clearly that the cost of electricity did not go up along with all other commodities; instead, it steadily declined. In other words, there was no increased height from which it could come down
The
SOUTHERN SIERRAS POWER COMPANY

Mr. West says:

Consumers should be made to realize through advertising that:

1. Comparative electric rates are lower than commodity prices, the unit costs of government and municipal water rates.

2. Monthly electric bills may be higher because of increased uses and not rates.

3. Electricity forms a small percentage of the average household budget.

4. Gross and surplus earnings of the companies are greatly reduced.

5. Despite the fact that power company taxes have been increased, rates have been reduced.

6. Companies have taken radical steps in reducing expenses.

7. Financial integrity must be protected if adequate service is to be rendered.

8. Any impairment of power company bonds will seriously affect financial standing of life insurance companies, banks, etc.

the power companies with a most difficult problem. In this connection bring out that as to the principal items of cost—to-wit: fixed charges, taxes and depreciation—the managements of power companies have practically no control, so that a comparatively small reduction in gross will involve a large reduction in surplus earnings.

8. Develop the radical steps that have been taken by the power companies to reduce expenses, such as the establishment of the five-day week and straight salary reductions affecting the entire personnel from the president down.

9. Develop the importance from the standpoint of the public of maintaining the financial integrity of the power companies by reason of the effect this will have:

(a) On the ability to render adequate service. (Impaired service could cost the consumer far more than any saving from possible rate reductions.)

(b) The effect on life insurance companies, savings banks and other investment concerns in which the people as a whole are deeply concerned, bringing out the fact that today bonds of this class represent on an average the most important bond holdings of the institutions referred to.

(c) Bring out the fact that the power companies' stocks, both common and preferred, are held in the main part by a vast number of small holders who are dependent upon the dividends these securities pay.

There are few people who are not vitally interested in the difficult problem of meeting overhead expenses, either in business or domestic affairs. As the monthly bills come around and the checking account at the bank is depleted in trying to meet them, it is not surprising that the average citizen should protest every item that is higher than it used to be or the unit cost of which does not seem to have been reduced in comparison with those that have in recent years rapidly declined. In no activities have more complaints been registered or demands made for rate reductions than those served by the public utilities, and there has been an especially insistent demand for a general reduction in electric light and power rates.

Electricity has become a necessity in the home. The spread of misinformation about its units of cost to consumers, therefore, may attract the attention of hundreds of thousands of people, and unless it is effectively controverted it becomes accepted as fact, and results not only in pressure being brought to bear upon regulatory commissions for rate reductions but also a clamor on the part of politicians either to usurp the prerogatives of the commissions themselves by granting rebates on rates already paid or to penalize the companies by a heavy increase in their gross earnings tax.

Owing to the fact that the average consumer has been steadily increasing the number of electrical appliances in his business or his home, it is not surprising that monthly bills in many instances have increased, and he is inclined not to distinguish the difference between an increased monthly bill and the unit rate he pays, which will be found, if carefully studied, to be lower than it was a few years ago.

It is not necessary to enlarge upon these arguments in an electrical industry publication. They have been made time and time again and charts have appeared frequently proving that electric rates did not rise in proportion to other costs during and after the war and are lower now on the basis of 1914 prices.

The point I desire to make, however, is that the people at large do not read the electric magazines and it is important to present the story to them in the newspapers and periodicals generally circulated in the territories served by the respective power companies, if for no other reason than to disabuse their minds of a prejudice against these companies because rates have apparently not in recent years declined as fast as commodity prices.

8,000,000 Kw. Is Columbia River Goal

P.W.A. projects at Grand Coulee and Bonneville on the Columbia River will more than double the existing available generating capacity in Oregon, Washington and Idaho. But the complete development of the river will quadruple this capacity and give 8,000,000 kw. The Columbia is 1,210 miles long and the entire drainage basin of 259,000 square miles has a run-off of 146,000,000 acre-feet, about ten times that of the Colorado at Boulder Dam.

To bring about the complete development army engineers propose ten dams with heights as follows: Grand Coulee, 430 ft.; Foster Creek, 200 ft.; Chelan, 120 ft.; Rocky Beach, 100 ft.; Priest Rapids, 150 ft.; Umatilla Rapids, 330 ft.; John Day Rapids, 258 ft.;

The Dalles, 150 ft., and Bonneville, 72 ft. The total cost of these developments is estimated at about $1,000,000,000 for power alone. These plants would produce 41,000,000,000 kw.-hr. annually. This is the dream of the Columbia that shades all other projects.

Grand Coulee the key plant

Grand Coulee is the key project of the whole development and is furthest up the river, being about 60 miles west of Spokane in a sparsely settled area. It has an appropriation of $63,000,000 to start with. The dam will be 450 ft. high and will be a concrete dam of gravity section with a crest length of 1,400 ft. It will create a lake 120 square miles in area, which, with an 80-ft. drawdown, will provide a storage of 5,000,000 acre-feet and will increase the minimum stream flow below the dam from 17,000 sec.-ft. to 40,000 or 50,000 sec.-ft. The average river flow at Grand Coulee is 109,000 sec.-ft. The potential salable firm power available at this site is 800,000 kw.

The power house structure on the downstream toe of the dam will be 1,028 ft. long and 72 ft. wide. Fifteen main generating units, each of 105,000 kw., and two smaller house generators are proposed for the ultimate installation. Each generator will be driven by a 147,000-hp. reaction turbine at 120 r.p.m. Each generator will have its own governing and excitation system and will feed a 22,000-volt transformer bank directly for stepping up to 220,000 volts for transmission. One outgoing line per generator is contemplated and in addition five generators will supply power to twenty pumping units, which will be the ultimate installation for irrigation. Three units only will be installed initially. The cost of the project, of which $204,000,000 is charged to power, is to be amortized from power sales and from a charge of $2.50 per acre per year for irrigated land, the latter including a $1 pumping charge. For the ultimate development the power cost is 1.5 mills and this is expected to be sold at an average price of 2.25 mills.

Bonneville aids navigation

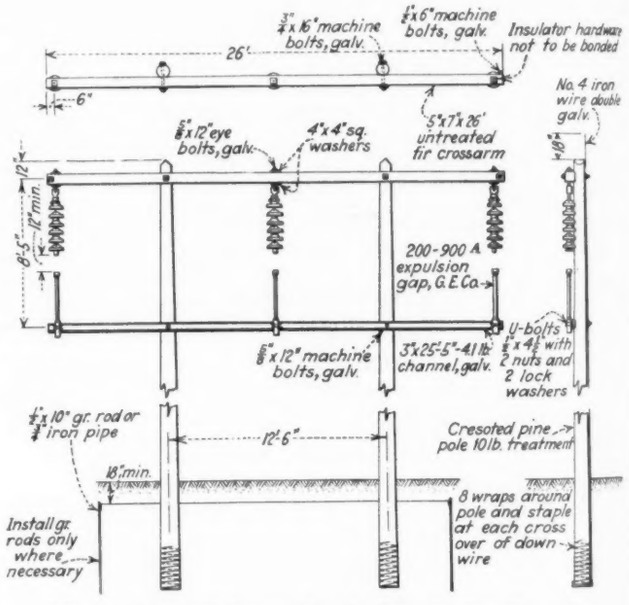
Bonneville project, now under construction, is 42 miles east of Portland and is essentially a river and harbor improvement project, although also a part of the whole Columbia power scheme. The Bonneville dam will be 72 ft. high and will store 60,000 acre-feet. The ultimate capacity of the power plant will be 540,000 kw. At the dam site the average river flow is 200,000 sec.-ft., ranging from a minimum of 50,000 to a maximum of 1,170,000. The dam will conform to the river channels at this point and will consist of four main structures with power house and locks located adjacent to each other. The initial power installation will be two units, each of 45,000 kw., but the foundation will be made for the ultimate installation of ten or twelve units. The total cost of this development is estimated at $31,000,000, of which $20,000,000 has been appropriated. Ultimate annual output is estimated as 1,500,000,000 kw.-hr. The cost of the project is to be liquidated exclusively by the sale of power. About $15,000,000 of the investment, however, is to be charged to river and harbor funds. Estimated cost of power at switchboard is 1.5 mills under these assumptions.

Combined output of Bonneville and Grand Coulee is expected to be 10,000,000,000 kw.-hr. a year in a large transmission area where the 1930 demands were only 4,000,000,000 kw.-hr.

· · · INDUSTRY

New Wood-Pole Line Has Latest Practices

A twenty-mile section 110-kv. H-frame wood-pole line under construction by the Carolina Power & Light Company embodies some very interesting features. This line is part of a 70-mile dual ownership tie being built to interconnect with the Tide Water Power Company. It is designed for a nominal loading of about 25,000 kw. Service continuity was a decisive consideration in the design of the line as well as economy. This 20-mile section is typical of the design for the entire 70-mile line


¾" x 16" machine bolts, galv.
¾" x 6" machine bolts, galv.
Insulator hardware not to be bonded
26'
6"
No. 4 iron wire double galv.
⅞" x 12" eye bolts, galv.
4" x 4" sq. washers
5" x 7" x 26' untreated fir crossarm
12"
12" min.
8'-5"
200-900 A expulsion gap, G.E.Co.
⅝" x 12" machine bolts, galv.
3" x 25'-5"-4.1 lb. channel, galv.
U-bolts ⅝" x 4½" with 2 nuts and 2 lock washers
¾" x 10' gr. rod or 3" iron pipe
12'-6"
Creosoted pine pole 10 lb. treatment
18" min.
8 wraps around pole and staple at each cross over of down wire
Install gr. rods only where necessary

New 110-kv. H-frame line in North Carolina uses Pittman tubes

and provides for medium loading and uses Class 5 creosoted pine poles.

The accompanying illustration shows the design of the tangential H-frame structure. The top crossarm is unbonded, grounding wires are used on the poles only and three Pittman tubes, designed with special base clamps for "hot line" working, are mounted on iron channels as shown. These tubes are so set that flashes are interrupted in ½ cycle, with consequently no breaker operation. Where ground conditions are bad special interconnected rods will be driven in addition to the wrapped pole-butt ground wire.

Another interesting feature of the line is the prestretching of the A.C.S.R. conductor during construction. This will be over-pulled to about 5,500 lb. as an aid in preventing vibration by putting the vibration stress on the steel core and not on the relatively slack aluminum strands. In addition Stockbridge dampers will be used on the conductors.

Operation of this new line will be awaited with in-

PRACTICES IN BRIEF . . .

terest by transmission engineers. It embodies the latest devices and the latest theory of transmission protection where overhead ground wires are not employed and should give splendid service.

Electrical Heat Maintains Uniform Vault Temperature

Close temperature control possible with electric heat is responsible for the installation recently in a precision instrument room of the Warner & Swasey Company of Cleveland, Ohio, of three 1,500-watt floor-type space heaters to maintain an unvarying temperature. Thermostatically controlled, these three heaters must hold the room at 85 deg. day and night, year in and year out, with an allowable variation of never more than plus or minus three-quarters of 1 deg. F.

Kept under lock and key in a basement room sealed against air leakage, a very accurate dividing engine, carefully protected against temperature change, rests on springs on a special steel foundation with the thermostat suspended directly overhead. The engine is used to inscribe minute divisions on telescope circles, a job where accuracy must be within one second of arc. Belt-driven from a ¼-hp. motor, the machine also graduates circles for accurate gear-cutting machines. For the latter work, of course, the degree of accuracy necessary for a telescope circle is not needed. An error of one second in a circle means 1 in. in 3 miles—serious only when dealing with the millions of miles involved in astronomical measurements and calculations.

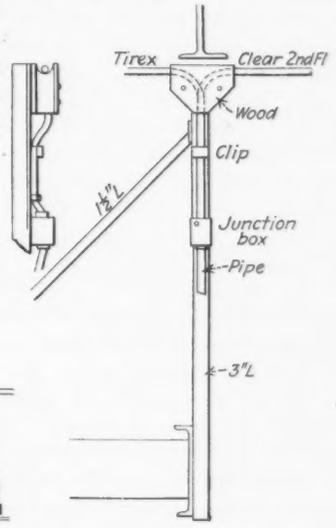
Thermostat-protected dividing engine kept at 85 deg. F.

Operation of the dividing engine is entirely automatic; it averages seven to eight hours per circle, depending on whether the scale divisions are to be in minutes, seconds or degrees.

Gas-Tight Equipment Safeguards Chemical Mixer

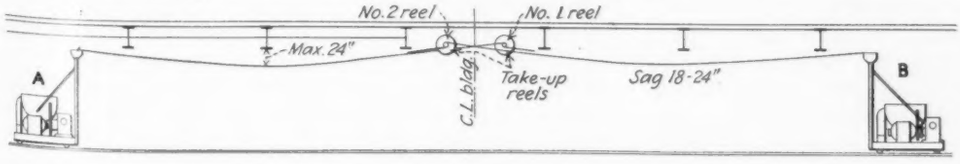
In the mixing room of the Rumford (R. I.) Chemical Works two movable mixers operated by electric motors are in service in an atmosphere where flames or sparks cannot be permitted to occur. Each mixer is mounted on a truck which travels back and forth on trackage, enabling charges to be drawn from one of several scale hoppers into the mixer, after which the mixing is done and the unit placed above one of several holes in the floor through which the material is discharged into filling lines below. The mixers are each propelled by a 5-hp. motor at 60 ft. per minute, and are driven for production purposes by a 20-hp. motor in each case. The motors are mounted upon the machines and travel with them, being 550-volt, three-phase General Electric induction units. Gas-tight, oil-break starters are located on the trucks.

To supply energy to the motors each machine is provided with 50 ft. of "Tirex" No. 8 cable, which terminates at a reel mounted on the ceiling near the center of the room, each reel being equipped with a spring motor designed to take up slack in the cable at various positions of the mixer on the run below. From the reels the cables are sagged to swing downward at guide boxes mounted on top of angle-iron frames above the mixers, wooden curved blocking being provided to minimize wear on the cables inside the boxes. A short downward run of cable terminates at a junction box on each vertical angle-piece, and from here the conductors are carried in 1-in. iron conduit to the motor starters. Collectors, also gas-tight, are located close to the reels. The reels, collectors and angle-iron structures used to support the cable were designed by J. L. Gleason & Company, Cambridge, Mass.



Method of bringing cable to mixer

Elevation of take-up reels and cable service to chemical plant mixers



LETTERS TO THE EDITOR

Market Development Requires Organization

To the Editor of the ELECTRICAL WORLD:

I was greatly interested in the ELECTRICAL WORLD editorial of January 27, 1934, which urges the formation of a central executive committee for the electrical industry. This editorial deals with two major points on which co-operation is required. First, on the matter of codes of fair practices under the NRA and, second, on the question of co-operative market development.

I have been active on both of these matters, and especially during the last few months I have spent a great deal of time in connection with development of codes of fair practice and efforts toward stabilization in certain sections of the industry. Based upon my experience, I do *not* believe that any central executive committee can properly handle both problems. Those co-operative matters which must be done in connection with codes of fair practice and a measure of price stabilization, including the proper definition of channels of distribution, are problems that have to be handled through the official co-operation of the various code authorities and through official agencies, as, for example, the supervisory agencies in the case of the electrical manufacturing industry and the supplementary code authorities and divisional code authorities in the wholesaling industry.

As you know, under the permissive trade practices section of the wholesaling code recently signed by the President, wholesalers and manufacturers are permitted to get together and to agree upon stabilization of distribution channels. This, to my mind, is one of the most important matters which must be taken care of in our industry before we can ever get the wholesaling industry interested in market development and sales development problems.

Suggests national and regional market development

There is also the problem of the electrical contractors and the protection to which they are entitled. All discussions on these matters must be by product divisions and anything constructive can only be developed as a result of conferences which will take up each specific product division and its problems. It is possible that there may be certain general principles, and for that purpose undoubtedly each code authority in the industry should appoint a committee which would act in a joint conference and which would, of course, have to be recognized and have the approval of the recovery Administrator.

Now I want to make it clear again that in my opinion we must solve this phase of our problem first, because most any industry has spent thousands of dollars in trying to clean house and develop codes and get organized to work under these codes, and we must see this phase of the job through before we can tackle something else.

All of this could be organized properly and a great deal could be accomplished within the next four or five months if everybody will put his shoulder to the wheel.

From the viewpoint of market development, I sincerely believe there should be national councils similar to the Refrigeration Council and the Cooking Council. For example, there ought to be one council on lighting, another one on air conditioning and perhaps a third one on various types of home appliances. These councils should be representative of the industry and should develop programs along a national basis which could be carried through by local leagues and local councils which may have to be organized in each territory. Any general industry committee is of no value whatsoever for the purpose of market development, because the problems of the refrigeration group are entirely different and have nothing in common whatsoever with the lighting people. If it is thought desirable, there could be a final co-ordinating committee of these different councils so that the dates of these programs and some of the efforts could be co-ordinated, but fundamentally the organization should start with different councils or group activities.

Incidentally, in connection with most of these activities, I believe that the country would have to be divided into regions, perhaps on the basis of the present wholesaling trade territories, and for each region there will have to be some agency of the basic code authority. Undoubtedly the electrical wholesalers' code will provide for that, and I believe the electrical manufacturers and contractors will have to work something out along those lines. This region, when set up, could also be utilized in the sales and market development phase of the program. There is no reason why, for example, the New England region could not carry through an active program on lighting development right at the present time, while another part of the country may have a different activity.

I have taken particular pains to outline this viewpoint because I am extremely fearful of another national industry committee which would be composed of six or seven well-known men who do not have the proper ability to permit them to organize on a sound basis a real industry activity. Surely, under the legal restrictions of the various codes and the authority granted the code authorities, such an industry committee would have no standing unless it were organized through the code authorities and with the approval of the NRA. On the other hand, code authorities have nothing to do with market development and there should be some active promotional effort in the various major divisions and branches of our industry, and I should say that in addition to the two we now have we should have something on lighting and something on air conditioning this year.

R. W. STAUD.
Sales Promotion Manager.
Benjamin Electric Company,
Des Plaines, Ill.

Thin Oil Not Used in English Cable

To the Editor of the ELECTRICAL WORLD:

In your issue of January 6, 1934 (page 46), under the heading "Engineering Reports—News from the Underground System," you have credited me with a description of a solid English cable for 66 kv. which is evacuated and impregnated with a ***thin*** oil after the sheath is applied. The expression *thin oil* is not entirely correct, since it suggests oil of the type used in oil-duct cable. In point of fact, it is a feature of the process

described that compound of the normal type used in solid cable, i.e., of the order of 100 times the viscosity of that used on oil-duct cable work, can be applied during impregnation (after sheathing) without any special ducts or devices. The cable therefore cannot be distinguished visually from tank-impregnated cable and has all the well-known merits of normal solid cable coupled with certain improved characteristics.

T. R. SCOTT,
Chief Engineer Power Cable Division.
Standard Telephone & Cables, Ltd.,
London, England.

BOOK REVIEWS

The Physics of Electron Tubes

By L. R. Koller. Published by McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y. 197 pages, illustrated. Price, $3.

Neither primarily mathematical nor qualitative, this book gives a middle ground treatment of the physical happenings inside electron tubes. It had its origin in a short course at M.I.T. and that explains the condensation. Nevertheless, it moves connectedly from application of the image theory to the analysis of electronic emission through thoriated filaments, caesium emission, secondary emission, elimination of gas vestiges and grid action to the iron discharges in gases such as arcs, sparks, glows and coronas. Thyratrons and photo-cells (photoconductive, photo-voltaic, phototronic) are also discussed. Appendices develop Richardson's equation for temperature and emission, the Schottky voltage-acceleration relation and the 3/2 power law for voltage-current relations; otherwise, the many equations which appear are stated without rigorous proof. The book thus compresses into small space an excellent summary of the internal phenomena of electron tubes, no matter what may excite or control the emission and output.

Principles of Radio

By Keith Henney. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. Second edition, 478 pages, illustrated. Price, $3.50.

Naturally a book on radio principles, even if only five years old, would have to be largely rewritten for its second edition. New principles, new tubes and new controls for performance and quality have been found. Here, for example, the reflex circuit, once in, then out and now on the way back, is treated afresh for its new possibilities. The variable mu and combinations of diode, triode and pentode within one envelope, along with automatic tone control, automotive power supplies, anti-static antennas, are other instances in point.

All through, the author, associate editor of *Electronics*, has kept in mind presenting the principles of tube and circuit functioning so as to serve the industrial control experimenter and specialist as well as the one striving for a sound output. From no better source can an engineer, attempting to put tubes where they will simplify a control task, make sure he knows how tubes work and what they will do quantitatively. In this respect the book in its early chapters is a primer of radio rudiments in simple verbal and numerical language. When the resonant circuit is treated it is done so as to be as applicable to the G. E. system of elevator leveling and to carrier communication as to broadcast tuning.

Tables of Integrals and Other Mathematical Data

By Herbert Bristol Dwight. Published by the Macmillan Company, 60 Fifth Avenue, New York. 218 pages. Price, $1.50.

Dr. Dwight, with his usual painstaking care and practicality, has assembled nearly a thousand of the most useful algebraic expansions, trigonometric transformations, calculus integrals, hyperbolic and elliptic functions and integrals, Bessels, gamma and gauss forms, etc. There are also chapters on differential equations and definite integrals. Logical classification makes it easy to find any of these literal expressions. Included, too, are tabulated values of many of these functions as well as natural and common logarithms and trigonometrics.

The Great Lakes-St. Lawrence Deep Waterway to the Sea

By Tom Ireland. Published by G. P. Putnam's Sons, 2 West 45th Street, New York, N. Y. 223 pages, illustrated. Price, $2.

Devoting but one of his fifteen chapters to the hydro power aspects, the author concludes that the St. Lawrence seaway is as indispensable to the landlocked Midwest as the Dardanelles to Russia and the Balkans. It is construed as the prime means whereby this country can meet the coming era of unparalleled intensity in competition for international trade. He avers the savings in exports and imports to the U. S. and Canada are to be so great as to make the outlay for the development a bargain investment. Proof is adduced from a multitude of authentic sources. Even New York and New England, in his opinion, will derive benefit greater than the harms scented by other writers.

The water power is called wholly incidental to the navigation. Upper New York will have a new seacoast immeasurably enhanced in commercial position with respect to both the Midwest and the East as a result of the power and the navigation acting in concert. Five to twelve million dollars in fuel will be saved. The arguments for the power development are much weaker, less comprehensive and more scantily substantiated than are the canalization benefits to which the other fifteen chapters are devoted. In those chapters great pains are taken to answer the arguments of opponents of treaty ratification.

Electrical Year Book 1934

Published by Emmott & Company, Ltd., 31 King Street West, Manchester, England. 303 pages. Price, 1/6 net.

Systematic rearrangement of the subject matter makes this new revised edition a useful book at hand for the industrial electrical engineer who shies at the expense of the large comprehensive handbooks. It has an amazing amount of data and explanation on electrical circuits, machinery, wiring, lighting, welding, testing, etc. There is nothing quite like it in this country at many times the price.

NEWS OF THE WEEK

St. Lawrence Ratification Fails in Senate Vote

Rejecting the St. Lawrence seaway treaty by a vote of 46 for and 42 against, where a two-thirds majority was needed, the Senate this week ignored a last-minute appeal from President Roosevelt for ratification. Calling for about $175,000,000 for navigation works, the project (ELECTRICAL WORLD, February 10, page 238; February 3, page 206) would also provide $84,726,000 for the development of water power to be allocated to the state of New York. The measure was originally sponsored by the Hoover administration. Undismayed by the result of the vote, the President announced that the subject would be brought up again. No further congressional action is believed likely at this session.

T.V.A. Appliances Displayed

Refrigerator prices too high, Lilienthal says. New York exhibit attracts interested electrical groups.

LOW-PRICED electrical appliances were brought a step nearer realization for the Tennessee Valley and by implication for the rest of the country on Tuesday of this week, when David E. Lilienthal, president of the E.H.F.A., and power director of the T.V.A., announced his approval of ranges offered for governmental inspection in response to specifications laid down by the former authority. In notifying range manufacturers of this decision Mr. Lilienthal said in part:

"I shall recommend that government financing be available on the basis of your price until August 1, 1934. Our technical committee advises me that you have not sacrificed quality or performance. This price reduction is in line with our urgent recommendation that a huge mass market would respond to substantially reduced prices . . . I am convinced that still greater reductions can be effected if the manufacturers have further time to study design, perhaps through a new approach to the structure of electric ranges. I urge those of you who are interested in further co-operating in the public interest to proceed to study the problem of reducing costs."

Tests must be made

Laboratory tests are to be conducted immediately upon these ranges under government auspices, and if these are favorable the directors of the E.H.F.A. will be asked to approve them for financing by the authority. Ten million dollars has been set aside by the R.F.C. for domestic appliance marketing purposes.

After carefully studying the proposed refrigerator prices Mr. Lilienthal concludes that the sealed proposals offered the government, while lower than the existing prices, are still too high to accomplish the wide distribution contemplated by the E.H.F.A. in the market represented by people of moderate and low incomes. Approval at this time is therefore withheld. "Our objective may call for an entirely new approach in electric refrigerator design," said Mr. Lilienthal, "in which costs are markedly reduced without loss of essential quality and durability . . . We suggest that, if interested, manufacturers study this matter of new design . . . in developing it permission is given to adopt such specifications as in the manufacturer's judgment will meet the needs of the public, having in mind our objectives of lowered cost, high quality and satisfactory performance . . . Such a program of design may well take several months. To meet the immediate need we recommend that costs be recalculated on the models submitted."

David Lilienthal

To water heater manufacturers Mr. Lilienthal held out the prospect of laboratory tests under government auspices before decision will be reached as to design suitability.

T.V.A. appliance exhibit

Thronging the doors at N.E.M.A. headquarters in New York last week to see the electric range, refrigerator and water heater designs offered for T.V.A. approval, many representatives of the electrical industry were given the chance to satisfy mounting curiosity as to the detailed features of these appliances as specified by the government in its domestic load-building program. Mr. Lilienthal was an interested visitor and stressed the necessity for reaching the mass market by pricing these devices far below $100 each. Although no prices were given out, figures as low as $50 for ranges and $75 for refrigerators have been bruited about.

Fourteen ranges, ten refrigerators and fifteen water heaters were displayed. These included two new electric ranges of ultra-compact size and rated at 7,230 and 6,500 watts, with spacious ovens, three hot plates each and thermostatic control. Neat, single-color finish with lacquering instead of multi-coated enameling featured nearly all the appliances shown. Savings in water heater construction were achieved in some cases by omitting drain valves, heat traps, bringing out cold water piping at the bottom of the tank to save material, and leaving local plumbers the job of completing the work. Plain stampings are used in some cases instead of spun covers; convenience outlets have been omitted from ranges, as have time clock controls, and single-unit elements provided with space for a second. Knockouts have been left for time clocks in some cases and framing has been lightened (one range saved 15 lb.).

The modern note in design is missing, but the essential working parts are standard and the refrigerators appear to be drawn from the usual minimum stock ratings. Two manufacturers showed clamp-on water heaters for marketing in the $35-$40 range of prices.

Range cuts 20-30% below retail

Later Mr. Lilienthal said that the range price cut offered ran 20 to 32 per cent under present retail quotations, with smaller slashes on refrigerators. He expressed confidence that most major lines will present satisfactory proposals before many weeks, new models being in the offing. The T.V.A. has received inquiries from Pacific Coast municipal and other utilities as to the prospect of marketing the new lines locally. The authority regards this as a fulcrum for prying lower rates out of such enterprises where justified. A potential valley refrigerator market of 150,000 units is coming into focus, said Mr. Lilienthal.

Fate of Lehman Bills Doubtful at Albany

Governor Lehman's much-disputed public utility program wound up its public hearings last week after utility leaders had subjected the New York executive's recommendations to another sharp attack. At the final session utility opposition was headed by Randall J. Le Boeuf, Jr., counsel for the Niagara Hudson Power Corporation, and Charles T. Russell, vice-president and general counsel of the New York Telephone Company. Mr. Le Boeuf centered his attack on the bills which would permit municipalities to build and operate their own plants and allow the Public Service Commission to order temporary rate decreases down to a point where they could be based on a 5 per cent return.

Strangulation feared

Mr. Russell attacked the proposals to give the Public Service Commission additional power of regulation, saying: "The fact is that the commission now has full power of regulation and these proposed bills, taken together, would not be in furtherance of regulation but of strangulation of an important industry, one of the most important in the state." Referring to the derision with which Milo Maltbie, commission chairman, discussed efforts to "drag in widows and orphans" dependent on utility investments (ELECTRICAL WORLD, March 3, page 343), Mr. Russell said: "The supporters of these bills cannot laugh off with derision the widows and orphans who are interested in such securities. Moreover, the widows and orphans are but one class. The investors in public utility securities are to be found in every walk of life, and they are by no means confined to the wealthy or the well to do."

St. Louis Presents $375,000 Tax Bill

Holding the Laclede Light & Power Company to be subject to a 5 per cent gross earnings tax by the city of St. Louis, City Counselor Hay last week billed that utility for $375,204, which he contends is the amount of taxes due for the past five years. After a survey the city found that the company, in addition to the Laclede Gas Light Company and the Western Union and Postal Telegraph companies, failed to make semi-annual reports under Section 2095 of the revised city code of 1926, which also required a 5 per cent payment on gross earnings.

The bill charges that although the statute of limitations eliminates taxes due prior to July 1, 1929, the company is not absolved from the 5 per cent payment on $7,517,204 in the last five years. If payment is not made in 30 days the city will take "appropriate" action to enforce the liability. The original ordinance under which the action is taken was enacted sixteen years ago.

Industrial Lighting Sales Well Repay Efforts

That industrial lighting campaigns conducted as part of the Edison Electric Institute's lighting activity pay dividends to both customer and utility can be seen from the reports of some companies' participation in the campaign. In Boston recommendations and surveys indicate so far an approximate doubling of wattage in many Boston factories. On the first 30 jobs the increase recommended was 111 per cent of original capacity, while the first seven jobs installed involved an increase of 233 per cent. In Chicago each Commonwealth Edison campaigner sold 102 fixtures at an average cost of $6, $839 in wiring contracts and added $1,100 in revenue. Modernized lighting by the Meissner Manufacturing Company stepped up production 16 per cent, the lighting intensity being increased from 5 to between 25 and 60 foot-candles.

The Cleveland Electric Illuminating Company testifies that each territorial representative adds $1,000 weekly to the company's revenue at the rate of $20 per kilowatt of commercial load connected. Most of this total is lighting load. Georgia Power Company reports that each commercial representative adds about $1,500 per month of revenue, of which $1,000 is new business, while the expense of getting such business is only $1 for each $5 in lighting revenue, and the salesmen in the industrial division increase revenue at the rate of ten times the cost of acquiring it.

Georgia Power Sued

Suit for $287,500 has been filed against Georgia Power Company by the Toccoa Falls Light & Power Company for breach of contract in failing to supply the plaintiff with power. The contract was alleged to have been made in 1915. Toccoa company seeks to collect profits which it asserts would have resulted had the contract been fulfilled.

Kansas City Sets Record

With an accident record for 1933 of 3.5 per 100,000 miles, far below the national average of 4.07, the Kansas City Power & Light Company awarded placards to be placed on the company's line, trouble and construction trucks which have been operated without accident for a period of four years.

PLAYING BRIDGE ON THE FIRING LINE

To show the Lorain Parent-Teachers' Association that spades are no longer trumps in the modern boiler plant, the Ohio Public Service Company recently opened its Edgewater station boiler room to 160 members of that organization for a bridge party amid novel surroundings. Part of the turbine room was turned into an appliance display area, and the quiet and cleanliness of the establishment aroused much favorable comment from the visitors

Coming Meetings

Edison Electric Institute—Engineering Committee Meetings, Cleveland, Ohio, March 26-29. Convention, Atlantic City, N. J., June 4-7. B. F. Weadock, 420 Lexington Ave., New York.

Association of Iron and Steel Electrical Engineers—Youngstown, Ohio, April 12. J. L. Kelly, Empire Building, Pittsburgh.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20. N. R. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer Convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

Johnson Bill Hearing Stirs Lively Debate

Dormant since its passage by the Senate a month ago (ELECTRICAL WORLD, February 17, page 270), the Johnson bill which would prohibit utilities from appealing to federal courts in rate cases found a multitude of proponents and adversaries clamoring to express their opinions before the House judiciary committee as hearings on the bill opened.

Expressing doubt that the bill is constitutional, Edward W. Everett of Chicago, spokesman for the American Bar Association, said his group was definitely against any action which would have the effect of weakening the jurisdiction of federal courts.

The rights of thousands of small investors in utility stocks and bonds would be impaired by passage of the bill, according to a brief filed with the committee by Rush C. Butler, counsel for the American Federation of Utility Investors, Inc.

Discrimination charged

Discrimination against utilities as compared with unregulated industry was charged by the Consolidated Gas Company of New York in a memorandum questioning the constitutionality of the bill. The memorandum contends that the purpose, in effect, of the bill is "to continue full protection of the property interests of unregulated industry which is not exposed to possible arbitrary action by state agencies, while denying full and ready access to an independent federal judiciary to the only industries which might require such relief."

Proponents of the proposed law were vociferous in their support of the measure. Defending the constitutionality of his bill, Senator Johnson, Republican, California, asserted that "the utility companies want to take two bites of the cherry where every one else is permitted but one."

Alvin C. Reis, general counsel of the Public Service Commission of Wisconsin, told the committee that the proposed legislation was necessary if the state regulation of utilities is not to become a "mockery."

H. Lester Hooker, chairman of the Corporation Commission of Virginia; Milo R. Maltbie, chairman of the New York Public Service Commission; Perry McCart, chairman of the Indiana Public Service Commission, and other leading commission executives appeared in support of the bill. The measure now awaits a final report from the judiciary committee.

Oklahomans Study Public Ownership

Frank treatment of agitation against private companies features convention program. Resolute policies favored by executives.

CHEERFUL in the face of adversity, 550 delegates to the sixteenth annual convention of the Oklahoma Utilities Association met last week in Tulsa to discuss a program in which government ownership of utilities held the center of the stage. Heading the list of outspoken foes of public ownership were Major H. S. Bennion, assistant managing director Edison Electric Institute; J. F. Owens, president Oklahoma Gas & Electric Company; J. A. Whitlow, vice-president Public Service Company of Oklahoma; E. E. McInnis, general counsel Atchison, Topeka & Santa Fe Railroad, and C. C. Deering, United States Independent Telephone Association. The convention was characterized by a note of vigorous opposition to governmental interference with business and the determination to return to local service problems with faith in the common sense of the American public in dictating future policies.

Bennion discusses municipals

Major Bennion declared that in times of stress an industry usually makes real advances because of the redoubled effort necessary to surmount difficult situations. Engineering seeking lower distribution costs will bear fruit for ten years to come. Increased use per customer points the way to further reductions in electrical unit costs, in the effort to offset the crippling effect of excessive taxation. Low unit prices for energy are functions of local conditions in cooking and water heating rather than type of system ownership. The volume of public discussion of government ownership now current misleads many into believing that a tidal wave is about to sweep private companies away, whereas the actual stimulus to abandon the latter form of service is overestimated as to strength. Municipal plants serve but 1,862 communities in this country, against 38,000 communities under private supply. Private companies serve 92 per cent of the people.

Records of recently established municipal plants are not as alluring as some set forth by the "melon-cutting" public enterprises, since it is much easier to build up a business in an unsaturated field than in a long-established area of use. The low level of rates generally existing throughout the country, coupled with the more exacting demand for higher service standards, leaves a much narrower possible margin between income and outgo than a generation ago before the rate of population increase had been sharply checked. In 1932 municipal plants sold less than 6 per cent of the country's energy; two-thirds of those established over the years have been disposed of, and in the next half-decade the crop of failures of plants built under the pay-out-of-earnings plan will be large. Given anything like a fair chance private ownership will continue to assert its superiority.

Tax favoritism opposed

E. F. McKay, manager of the association, cited rising opposition of taxpayers to the exemption of municipal plants from such levies. He said that the public ownership trend is lessening in Oklahoma. Federal P.W.A. appropriations for municipal plants are not making the headway originally expected, probably because municipal credit is not what it once was.

Officers elected, following presentation of various operating topics, were: President, H. B. Cobban; vice-presidents, W. B. Head, Jr., and C. A. Breitung; treasurer, W. R. Emerson; manager, E. F. McKay.

Coal Asks Fair Play in U. S. Power Projects

Demanding fair play from the government, the bituminous coal industry, through C. B. Huntress, executive secretary of the National Coal Association, has protested against the promotion of government-financed hydro-electric power projects as inimical to the coal industry. In a statement demanding cessation of alleged discrimination against coal in government contracts for heat and power, Mr. Huntress urged the creation of a co-ordinating board to deal with competitive sources.

"We denounce the policy now being

Power can be generated from coal more cheaply than by hydro-electric plants, yet for whatever reason the government is promoting vast hydro-electric projects . . . About the only restriction in the Norris bill to create a Missouri Valley Authority is that they must build a dam at some point where water doesn't run up hill and that the United States shall write a blank check to finance it . . . Such a policy is destructive of the interests of the coal industry; it will restrict its productive capacity and increase unemployment. It is not a sound policy to destroy permanent jobs in America and substitute for them only an equal number of temporary jobs, and that is about what the hydro-electric propositions amount to in their final analysis.

JOHN L. LEWIS,
President United Mine Workers of America.

promoted by the T.V.A. and Public Works Administrator Ickes," the statement said, "wherein hundreds of millions of the taxpayers' dollars are being diverted to developing hydro-electric power, which in many instances will simply displace existing low-cost steam power, thereby increasing rather than relieving unemployment."

Mid-West operators protest

A possible non-production of 4,000,000 tons of coal annually, and the consequent loss of employment of 10,000 coal miners and railroad men, is forecast by the National Bituminous Coal Code Authority of Iowa, Indiana and Illinois if two power projects now introduced in Congress are put into operation. Protest against application of the power phases of the Missouri Valley and Arkansas River projects incorporated in measures now before both houses of Congress were made in a letter addressed to congressional committees on flood control, and irrigation and reclamation. It was asserted that "the building of the contemplated hydro-electric plants would be a duplication of existing facilities," and that "tremendous losses of capital invested in the coal properties of these areas and untold suffering in the mining communities would result."

Tie-up in New Haven

New Haven, Conn., and its environs went dead dark last Sunday evening for about an hour until bus trouble at the United Illuminating Company's Grand Avenue generating station could be cleared. A short circuit between the differential current transformer and the machine-to-bus breaker upset normal relay action, causing extensive damage at the bus. Rioting broke out in the county jail; the New Haven railroad had to abandon freight operations at its Cedar Hill yards as the switches depend on utility power. The principal other untoward incident was a one-extinguisher blaze in the station bus gallery when a toolbox caught fire from the heat of the fault current.

State Legislators Act on Utility Bills

Definite action has been taken by several state legislatures on utility measures which have been under consideration for some time past. After acrimonious exchanges the finance committee of the Virginia Senate voted out the Peery tax program (ELECTRICAL WORLD, February 10, page 236, and January 27, page 164), with the recommendation that the bill should not pass. This action was taken following a public hearing at which utilities' representatives severely criticised the bill. The measure would raise the tax on gross receipts of utility companies from 1⅛ per cent to 3 per cent.

Previously the bill providing that the Virginia State Corporation Commission may fix temporary rates for utility companies was approved by the Senate finance committee. T. Justin Moore, spokesman for the utility companies at the hearing, questioned the constitutionality of the proposal. The Virginia House appropriations committee killed the bill which would have restored to the State Corporation Commission funds amounting to $260,000 in income from the tax on utilities for rate investigation purposes. This amount had been taken from the fund and put in the general fund. The measure that was slaughtered would have returned this amount to the commission.

A bill creating a state public service commission to regulate utilities was passed by the Kentucky State Senate and sent to Gov. Ruby Laffoon.

As a step toward the early completion of the water storage and hydro-electric power dam on the Colorado River at a point about 50 miles above Austin, the State Senate has passed a bill creating a conservation and reclamation district to be called the Colorado River Authority.

Grange power bill

The Grange power bill, in litigation since its passage by the regular session of the Oregon Legislature in 1933, will go on the ballot of the 1934 general election in November under a referendum sponsored by the Security Owners Association of that state, according to a court ruling announced February 22. The bill provides for a power commission with authority to build plants and lines for the sale of electric power and to issue bonds for this purpose.

An elective public utility commission was provided for in a bill introduced last week in the New Jersey Senate by Senate President Clifford R. Powell. The terms of the present members, named by the Governor, would be terminated by the bill at the end of the year and three members would receive $7,500 a year. The salary now is $12,000. Candidates for the board would be required to enter the primary election the same as aspirants for other elective offices.

MERRY-GO-ROUND

Knoxville may have two electric distribution systems, David Lilienthal revealed this week. Declaring that the negotiations with C. E. Groesbeck have not been very happy, Mr. Lilienthal stated the company's offer to follow the "utilities' favorite formula of cost of reproduction at present prices." On behalf of Mr. Groesbeck, it was stated that the proposal is to take the profitable part of a property at actual value and leave the unprofitable part in the hands of his company.

Investigation of rates charged for electricity reached the House committee on interstate and foreign commerce. A favorable report quickly was forthcoming. Many power companies are said to favor the measure in that it promises an accurate analysis of rates charged by publicly owned plants.

Holding companies get their first favorable break in a long time and the Federal Trade Commission has doubt and uncertainty cast upon a fundamental feature of its act by the decision of the Supreme Court of the United States in the Arrow-Hart & Hegeman Electric Company case.

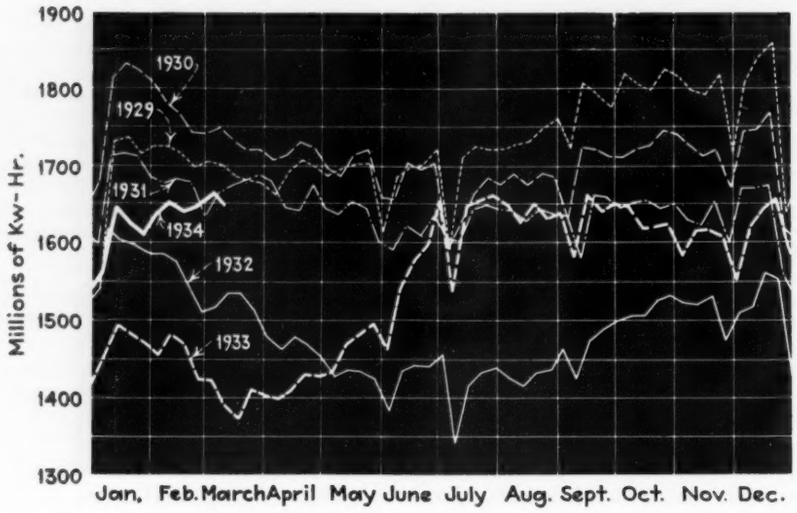
PAUL WOOTON,
Washington Correspondent.

Color Defect Overcome in Gas Discharge Lamps

By using a mixture of metallic vapors, color defects of existing gaseous discharge type lamps have been eliminated, according to engineers of the Siemens Electric Lamps & Supplies, Ltd., England, who have introduced a new type lamp known as Sieray "W" utilizing the new vapor mixture. This lamp has the same efficiency as earlier type lamps, 40 lumens per watt, and is provided with a starting device such that it can operate on voltages from 200 volts up. It was developed in the Preston Laboratories of the company, largely through the efforts of a young chemist, J. Aldington.

The spectrum obtained contains sufficient red, orange and yellow to remove the objections to discharge lamps on the ground of their harmful effect on appearance of complexions, clothing, meats, fruits, etc. It is said to be a definite advance toward the general adoption of discharge lamps for business streets and general interior use.

Energy Output at 1931 Level



Central-station energy output during the week ended March 10, amounting to 1,647,024,000 kw.-hr., according to the Edison Electric Institute, continued on the recent level. Despite a small decrease from the preceding week it was exceeded on'y one other time and closely approached on only two other occasions since the beginning of 1934. The corresponding output of last year was surpassed by 18.4 per cent and of 1932 by 7 per cent. Average production for the past two weeks was about the same as in 1931.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Mar. 10...1,647	Mar. 11...1,391	Mar. 12...1,538
Mar. 3...1,658	Mar. 4...1,423	Mar. 5...1,520
Feb. 24...1,646	Feb. 25...1,426	Feb. 27...1,512
Feb. 17...1,641	Feb. 18...1,470	Feb. 20...1,545
Feb. 10...1,652	Feb. 11...1,483	Feb. 13...1,579

For three months there has been an almost uninterrupted widening of the margin over the preceding year's production, from 5.2 per cent in mid-December. Contrasting with recent firmness, output at this time in 1933, registering the disturbed conditions, was rapidly shrinking.

Regional gains are extraordinary, such as 27.6 per cent in the Central industrial area, 18.5 in the South, 17.0 in New England.

Per Cent Change from Previous Year

Region	Week ended Mar. 10	Mar. 3	Feb. 24
New England	+17.0	+15.7	+14.2
Middle Atlantic	+14.1	+15.3	+14.4
Central Industrial	+27.6	+24.6	+24.7
West Central	+12.7	+10.0	+ 7.5
Southern States	+18.5	+11.9	+ 4.1
Rocky Mountain	+15.7	+18.2	+16.3
Pacific Coast	+ 7.9	+ 7.7	+12.5
United States	+18.4	+16.5	+15.5

Congress May Curb P.W.A.; New Bill to Be Presented

Rigid congressional restrictions on future Public Works Administration spending aimed to prevent allocations to uneconomic projects are being definitely planned by majority members of the House appropriations committee. A legislative rider carrying this policy into effect is now under consideration by leading House Democrats and will be offered as a section of the forthcoming P.W.A. appropriations bill when it comes up in committee. President Roosevelt visualizes an elastic program, but in any case he will recommend that the funds appropriated must be kept within the budget already submitted. The administration will present a public works bill to Congress within the near future.

Violent disagreement still prevails at Washington on the efficiency of public works as an instrument of recovery, but both sides concede that a small appropriation is futile. Lewis Douglas, Director of the Budget, contends that a program sufficiently large to be effective will break the Treasury and that almost any other method of combining relief and employment is much cheaper.

Uprising in Iowa uses NRA ammunition

Iowa now occupies the spotlight in the public utility field, the Iowa City Light & Power Company making use of the NRA to restrain the city from going ahead with proposed plans for the construction of a municipal light and power plant. The utility has filed a petition to set aside an application for a federal loan and grant of $917,000 to be used for the construction of a plant with the state advisory board. The utility alleges that the construction of a municipal light plant in Iowa City is not consistent with NRA, which "aims to promote the fullest possible utilization of the present productive capacity of industries."

Tentative application to the P.W.A. by Newark, N. J., for a loan and grant of $30,000,000 for the construction of a municipal electric power plant has been rejected.

Application of the city of Waycross, Ga., for a grant from P.W.A. for $137,500 for the purpose of constructing a municipal power plant has been denied. Disapproval was based on the grounds that the amount would not be sufficient to give a distribution system "covering" the entire city; that the plant would set up municipal and private rates in the same corporate limits, and that there would be no guarantee that sections beyond the reach of the municipal system would continue to be served by private power interests.

P.W.A. power grants total 149

With a total outlay of $28,375,200, the Public Works Administration has issued loans and grants for power and light developments and improvements to 49 communities up to March 10. The communities and grants allowed are as follows:

Sheffield, Ala., $230,000; Tuscumbia, Ala., $130,000; Florence, Ala., $436,000; Conway, Ark., $45,000; Anaheim, Cal., $15,000; Ft. Collins, Col., $738,000; Ft. Pierce, Fla., $36,000; Augusta, Ga., $1,250,000; Springfield, Ill. $78,000; Terre Haute, Ind., $60,000; Tipton, Ind., $170,000; Columbia City, Ind., $29,000; Dubuque, Iowa, $6,300; Lawler, Iowa, $1,400; Chanute, Kan., $25,000; Burlington, Kan., $145,000; Anthony, Kan., $15,000; Butler County, Kan., $6,000; McPherson, Kan., $211,000; Middlesboro, Ky., $328,000; Alexandria, La., $250,000; Northampton, Mass., $360,000; Waltham, Mass., $12,000; Norfolk, Mass., $67,000; Belmont, Mass., $16,100; Allegan, Mich., $410,000; Blue Earth, Minn., $25,000; Preston, Minn., $21,500; Buhl, Minn., $34,000; Moberly, Mo., $700,000; Kennett, Mo., $150,000; Concordia, Mo., $47,000; California, Mo., $155,000; Gothenburg, Neb., $7,500,000; Columbus, Neb., $7,300,000; Fremont, Neb., $7,300,; Minden, Neb., $8,000; Hastings, Neb., $48,600; Shelby, Ohio, $160,000; Cushing, Okla., $350,000; Pawnee, Okla., $60,000; Chambersburg, Pa., $24,000; Knox County, Tenn., $2,600,000; Austin, Tex., $400,000; Burlington, Vt., $77,600; Culpeper, Va., $160,000; Danville, Va., $3,000,000; Hartford, Wis., $40,000.

Discuss P.C.E.A. Revival

Plans for reviving activities of the Pacific Coast Electrical Association and absorbing part of the program of the Pacific Coast Electrical Bureau, which has been abandoned, were discussed at a meeting of the P.C.E.A. executive committee in Los Angeles. A committee headed by A. W. Markwart, vice-president of Pacific Gas & Electric Company, was appointed to suggest a plan of operation.

As to Rates——

• Public Service Company of Northern Illinois reduced by approximately one million dollars its original estimates covering expenses properly chargeable to electric operations for 1933. Earlier figures of the company had been sharply attacked in cross-examination before the Illinois Commerce Commission. Among the major cuts was $600,000 in state, local and miscellaneous taxes, originally estimated at $1,640,000. Federal capital stock tax, estimated at $70,000, was reduced to $45,000. Legal expenses, originally $142,000 for the electric department, were reduced to $82,000. The estimate for rentals was reduced approximately $65,000 and other miscellaneous general expenses were cut approximately $90,000. Assistant Attorney Booth of the commission stated that in spite of these substantial reductions the company's estimates of operating expenses are still too high.

• Pacific Gas & Electric Company has filed an application with the California Railroad Commission for a temporary rate reduction to all agricultural power consumers on its lines for the period between the April and July meter readings because excess run-off will create a surplus of power at its hydro-electric plants during the early summer months. The temporary reduction contemplates a charge of one-half the regular rate for all energy used during that period over and above the amount of energy used during the same months in 1933. A similar temporary reduction was recently placed in effect by the San Joaquin Light & Power Corporation.

New Orleans cut ordered

New Orleans Public Service, Inc., has been ordered by the Commission Council of the city to reduce its domestic and small commercial electric rates from 17 to 70 per cent, effective on bills on and after April 15. Louisiana Light & Power Company, supplying the New Orleans area on the west side of the river, has been ordered to show cause why similar reductions should not be made. New rates would reduce New Orleans Public Service receipts by $653,123, it is estimated. Industrial and wholesale user rates had been reduced earlier by $378,167 a year. Holding the commission's order confiscatory, the corporation is considering whether to sue for an injunction to restrain the commission.

• Arkansas Power & Light Company's rate case before the state Corporation Commission on the petition of the city of Stuttgart has been continued for the second time to allow the company's lawyors and engineers and the city ample time to prepare whatever data are necessary to complete the investigation. Under questioning by P. A. Lasley, chairman of the commission, S. W. Kettleman, engineer for the company, admitted that his bases for unit construction costs were taken in part from the Phoenix Construction Company records, a subsidiary of the Arkansas company, and not wholly from company records. That construction contracts were awarded to the Phoenix Construction Company on a cost-plus basis was brought out by Mr. Lasley, who said that the larger the cost of construction the more the subsidiary was paid. H. G. Gothard, chief accountant for the tribunal, contended that uniform rates did not prevail throughout the system and that power sold by the company to public utilities in 1933 varied from 7 mills per kilowatt-hour to 40 cents.

• Indiana Service Corporation rate cases involving 27 cities and towns will be heard by the state Public Service Commission on March 27.

• Washington Department of Public Works has attacked the rates, valuation and service of the three major power companies of the state, the Puget Sound Power & Light Company, Washington Water Power Company and the Pacific Power & Light Company, in complaints issued against these utilities. The Chelan Electric Company was named co-defendant in the Washington Water Power complaint.

• Central Vermont Public Service Corporation has announced a reduction in rates for electricity for commercial lighting in Rutland. The cut ranges, according to William H. Lawson, general manager, from 2 per cent to customers who use 40 kw.-hr. a month to 10 per cent to users of 2,500 kw.-hr. a month.

• Kingsport Utilities Company has been authorized by the Tennessee Railroad and Public Utilities Commission to reduce domestic power charges $11,000 a year, effective April 1. The rate slash was voluntary. The company is a subsidiary of the American Gas & Electric Company.

Municipal Items

MILWAUKEE, WIS.—Investigation of an application by the city for permission to construct a $14,800,000 electric plant has been ordered by the state Public Service Commission. No date is set. Mayor Hoan and City Attorney Max Raskin contend that the city is already operating as an electric utility, but serving only the city government, and that permission of the commission is needed only for extension of its plant to general service. This contention is based upon the fact that the city owns a power plant as part of its sewerage system. Cost of the investigation and of appraisal of the city's utility property will be assessed against the city.

CUSHING, OKLA.—Voters have approved by 490 to 183 a $280,000 municipal light and power bond issue to take advantage of a federal public works loan and grant for $350,000 which already has been approved in Washington on the stipulation that new bonds be voted. At present the city is served by the Interstate Power Company, which recently filed with the Corporation Commission a new rate schedule showing substantial reductions from those formerly in effect.

MUNCIE, IND.—City Council has set April 24 as the date for an election to vote on the purchase of the light plant, a unit of the Indiana General Service Company. An injunction preventing the Council from acting has been sought in a suit filed in Circuit Court. The action asks that the city officials be forever restrained and enjoined from submitting to the voters of the city at any election the question whether the city shall purchase the company's holdings. The suit argues that the corporation is providing electrical service to nine adjoining counties, by means of an interconnecting electrical system, and that certain of the facilities cannot be separated without depreciating the remainder of the system.

LENOX, IOWA.—United States Circuit Court of Appeals has held that the city had a legal right to enter into a contract with Fairbanks, Morse & Company to purchase an electric generating plant for a municipal light and power system. The ruling sustains the decision of the Iowa District Court in dismissing an injunction suit brought by the Iowa Southern Utilities Company, which operates in the city under the terms of a franchise that does not expire until 1942.

NORWALK, OHIO.—United States Supreme Court remanded to the lower court the suit of the Chase National Bank, as successor trustee and mortgagee of the Ohio Electric Power Company, to enjoin this city from enforcing resolution passed by its Council requiring the company's removal of its electrical equipment from the streets. The company had a franchise to use the streets of the city in connection with the service.

GUTTENBURG, IOWA.—Special election will be held March 29 on a proposal that the city erect, maintain and operate a municipal light and power plant. The estimated cost of the project is that it will not exceed $70,000. The undertaking is to be paid for out of earnings without the necessity for a bond issue.

FINANCIAL · · · BUSINESS

Arrow-Hart & Hegeman Wins in Supreme Court

The right of two Connecticut wiring device manufacturers to merge in a declared effort to give the public lower costs and to maintain employment was upheld this week by the United States Supreme Court. The decision, which involved the Arrow-Hart & Hegeman Electric Company, Hartford, reversed the ruling of the Second Circuit Court of Appeals, which had upheld an order of the Federal Trade Commission refusing the companies permission to unite.

Maintaining that the two companies before the merger had been active competitors and that the consolidation had resulted in substantially lessening competition, the commission ruled that the merger of Arrow and Hart & Hegeman violated the Clayton anti-trust act. Originally, a holding company was organized, but the commission objected, whereupon a merger was arranged. When the Circuit Court of Appeals sustained the finding of the commission the company appealed to the Supreme Court (ELECTRICAL WORLD, September 9, page 329).

The new company contended that the merger was legal, asserted there had been no lessening of competition and declared it was in the interest of industrial recovery, improving employment conditions and giving the public lower prices.

In handing down the court's decision Justice Roberts declared that the "record is said to disclose that competition was not in fact diminished but preserved." He also said that the stock of the two companies was no longer owned by the holding company, "which had been dissolved" when the commission issued its order. "Not only is there a total absence of proof of injury to the public," he added, "but much affirmative evidence that consumers were benefited by reduction of prices consequent upon manufacturing efficiency made possible by unified control."

ENERGY HIGH

Dominating less spectacular business telltales by showing an 18.4 per cent gain over last year, electrical energy production this week lent further encouragement to industry. The gain was largest in the central industrial region, where a 27.6 per cent margin prevailed. Carloadings rose 5.4 per cent above last year in the week ended March 3 and preliminary figures point to a new year's high at the March 10 week-end. Automobile output continues gains and stands at 2.80 per cent of that a year ago. Steel and lumber activity decline slightly. Retail sales again improve.

Security prices divided their trends, bonds improving sharply, stocks demonstrating definite lethargy. Commodities displayed some weakness.

But for the newly imposed problem of continued existence in face of NRA-ordered 10 per cent working time cuts and corresponding wage increases the skies remain encouragingly blue.

Federal Trade Cites $118,747,654 Rate Slash

Pointing to savings to the consuming public of $118,747,654 as a result of electric rate reductions between 1930 and 1933 inclusive, the Federal Trade Commission claims no small credit for a large portion of the reductions obtained. "Of the $118,747,654 in estimated consumer savings resulting from rate cuts," the commission states, "reductions involving $66,454,240 have been made by companies affiliated with holding companies which have been under examination during the federal public utility inquiry."

That the cost of electric light and power energy to consumers is being steadily reduced, the commission asserted, is evidenced by figures recently carried by business journals showing that while sales of electrical energy during 1933 increased 3.1 per cent over 1932, the dollar cost of this power to the consumer decreased by 3.2 per cent under 1932.

Agreeing that court resistance to the cuts was being made in some instances, the commission held that any loss to the consumer that might result from this would be compensated or exceeded by rate reductions which had escaped the notice of the trade press, and in 58 cases noted for which no estimated savings were given.

Ford, Bacon & Davis Completes Fortieth Year

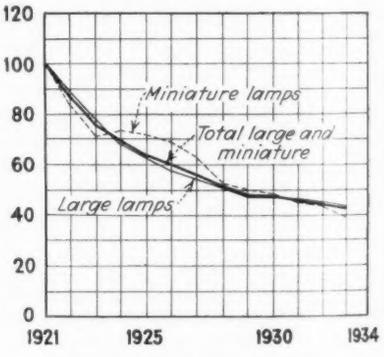
Several hundred friends and representatives of industry attended a reception this week at the New York home of George W. Bacon, chairman of the board of Ford, Bacon & Davis, in celebration of the 40th anniversary of this well-known firm of consulting engineers and managers. An illustrated exhibition of important projects and other work done by the firm, together with refreshments and dancing, afforded a happy combination of social and business intercourse.

This firm started 40 years ago through a partnership of two young men, one Frank R. Ford, just out of the University of Pennsylvania, and George W. Bacon of Cornell. Mr. Ford is no longer living. The firm quickly spread its work over the electrical field of construction and in later days to all types of construction, to appraisals, to management and to other consulting services to industry. Through Ford, Bacon & Davis, a half a billion dollars has been invested in the United States in street and steam railways, power plants, electrical transmission and distribution, bridges and tunnels, highways and terminals and industrial plants of all sorts.

Much work has been done on questions of rates for electricity, power, light, natural and artificial gas; transportation, water, telephone service, heating; rates, in fact, for all kinds of public utility service.

Lamp Prices Decline

Steadily falling prices are shown by a report recently issued by the incandescent lamp department of the General Electric Company. Referred to 1921



Trend of average list prices

as a base year, the average list price of domestic lamps for large lamps in 1933 was 42.8, for miniature lamps 37.9 and for both combined 41.8 per cent.

The compilation is stated to be based on all types of large and miniature (except Christmas tree) lamps listed in the regularly printed data books and price schedules. It does not include special lamps.

Contracting Under Code

Approving an amendment to the construction code, National Recovery Administrator Hugh S. Johnson has announced that the National Electrical Contractors' Association has been re-established as one of the sponsors of the code and electrical contracting has been placed under its jurisdiction.

Court Appoints Receiver for Portland Utility

Franklin T. Griffith, president of the Portland Electric Power Company, was appointed temporary receiver for the company last week by Federal District Judge John McNary on petition of Percy H. Clark of Philadelphia, following default on March 1 of interest payment on Portland Northwest Public Service Company 6 per cent debentures. The corporate name of Portland Northwest Public Service was changed to Portland Electric Power by action of the stockholders some time ago.

Mr. Griffith has offered a plan to the debenture holders whereby new 6 per cent collateral trust income bonds will be exchanged for an equal amount of the outstanding debentures and will mature on the same date, March 1, 1950 (ELECTRICAL WORLD, February 24, page 313). The new bonds will be secured by deposit of the entire capital stock of Portland General Electric Company now outstanding, except directors' qualifying shares, and also the entire capital stock of Portland Traction Company now outstanding, except directors' qualifying shares. Interest on the new bonds will be paid only out of available income and the company will pay at least 3 per cent during 1934.

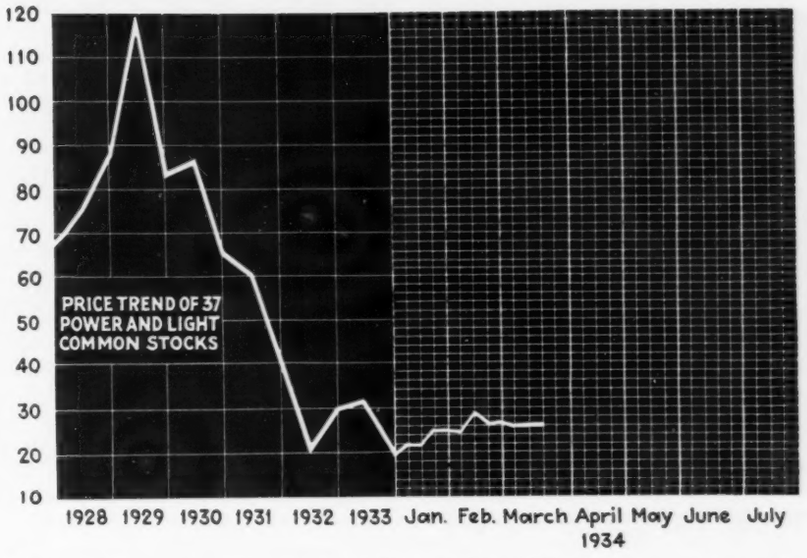
Portland General Electric has funded indebtedness of $54,115,000 outstanding. Of this amount $14,115,000 matures next year, $6,615,000 representing first mortgage bonds due July 1, 1935, and $7,500,000 representing general mortgage notes due August 1, 1935, deposited as collateral to secure a like bank loan extended to January 3, 1935.

National Power & Light Assailed in Birmingham

Six stockholders of the Birmingham Electric Company secured an attachment for $3,200,000 against the property of the National Power & Light Company last week from Circuit Judge J. Russell McElroy in Birmingham. Previously, as a result of charges brought by the preferred-stock holders of the Birmingham company, a National subsidiary, the Alabama Public Service Commission had issued orders looking toward the attempted recovery of funds which had been transferred from Birmingham to National. Both companies have denied the commission's right of jurisdiction (ELECTRICAL WORLD, February 24, page 308, and March 10, page 379).

The petition filed last week asks that upon final hearing the $3,200,000 be restored to the Birmingham utility and that a note for $279,000, assertedly borrowed from the holding company by the local utility, be declared void. Pending final hearing the petitioners asked that Birmingham Electric Company be restrained from paying further dividends to National.

Utility Stocks Slightly Higher



Light and power common stocks drifted slightly higher in a general security market notable for its lethargy. "Electrical World" index 26.2; last week 25.9.

Stock Increase Planned to Retire Note Issue

Preparing to meet maturing notes totaling $2,000,000 on April 1, North American Light & Power Company plans a change to increase authorized common stock by 125,000 shares and to change the common stock from no par value to a value of $1 a share. North American Company, which now holds directly or indirectly 66.47 per cent of North American Light & Power common stock, has offered to purchase additional common stock at $2.40 a share.

Stockholders, who will vote on the plan at a meeting scheduled for March 28, are asked to waive their preemptive rights to subscribe to stock in favor of North American Company.

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No Savannah Dividend

Directors of the Savannah (Ga.) Electric & Power Company have voted to defer payment of the semi-annual 3 per cent cumulative preferred dividend normally payable on April 2. In a letter to preferred-stock holders H. C. Foss, president, said: "Because of substantial reductions in gross incident to depressed conditions, a recent order by the Georgia Public Service Commission reducing residential rates by approximately $130,000 a year, and increased expenses due to the imposition of the federal 3 per cent energy tax and increased labor and material costs resulting from the application of NRA codes, the directors deemed it necessary and in the best interest of the security holders of the company to defer this dividend . . ."

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To Keep New York Tax?

Reinstatement of the local emergency tax on gross incomes of utility companies serving New York City as a means of raising revenue required by failure of the Legislature to pass the city economy bill was indicated last week by Mayor LaGuardia. A tax of 1½ per cent on utility earnings, imposed during the O'Brien administration, expired on February 28. The amount of tax to be levied, Mr. LaGuardia declared, would depend largely on the amount of new funds needed.

Privilege Taxes Approved

Reversing the decision of the lower court, the Alabama Supreme Court has ordered the Alabama Power Company to pay privilege taxes to the city of Dothan. The opinion said that although the company was delivering wholesale power to the city switchboard, it must use electric lines to do so, and therefore was doing business as a corporation within the city limits. The company contended that as the wholesale power was distributed through a municipal electric system, it should not be held liable for the tax.

Washer, Ironer Business Continues Long Rise

Breaking all records for January, shipments of household washing machines totaled 81,488 units, according to J. R. Bohnen, secretary of the American Washing Machine Manufacturers' Association.

"This is an increase of 71 per cent over the January, 1933, total of 47,653 washers and is the tenth consecutive monthly increase over the corresponding month in the previous year," states Secretary Bohnen. "It is also an increase of 46 per cent over December, 1933."

Indicative of the trend in ironer shipments is the sharp increase in January output. Such shipments totaled 6,826 units, compared with 4,173 units a year ago.

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Wider Oil-Burner Market

Stressing the stabilizing influence of the entrance of large corporations into the oil burner industry, T. K. Quinn, vice-president of the General Electric Company, held that the major task of the industry at the present time is to widen and extend its market, in an address before the National Oil Burner Convention and Exposition at Philadelphia.

Square D "in the Black"

Rising from a net loss of $124,487 in 1932, Square D Company shows a net income for 1933, after depreciation, interest and other charges, of $93,028, equal to 98 cents on each of 100,228 class A preferred shares.

Frigidaire Sales Campaign

Cognizant of the refrigerator sales possibilities for 1934, the Frigidaire Sales Corporation, subsidiary of General Motors Corporation, will introduce its new 1934 Frigidaire line with an extensive three months spring campaign beginning March 21. The new line of fifteen models in four series is the most complete in the company's history and is designed to meet the public demand based on its customer research findings. The line will be backed up with the most comprehensive sales promotion and advertising activity the company has launched in some years. Fifteen thousand dealers and distributors are receiving the details of the line and campaign in key cities and the drive will be launched simultaneously in 6,000 showrooms, department stores and utility sales rooms.

New York Metal Prices

	Mar. 6, 1934 Cents per Pound	Mar. 13, 1934 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.35	7.50
Nickel ingot	35.00	35.00
Zinc, spot	4.75	4.725
Tin, Straits	52.50	54.25
Aluminum, 99 per cent.	23.30	23.30

Westinghouse Sales Up 5 per Cent in 1933

Reversing a year's downward trend which carried its business to a low point in January, 1933, Westinghouse Electric & Manufacturing Company achieved a 5 per cent increase in orders during the past year, according to the annual report released this week. The 1933 orders totaled $72,473,117, compared with $69,082,468 in 1932. Volume accelerated during the final six months of 1933, the last half being 48 per cent ahead of the same 1932 period. Despite the increase in orders booked, billings fell from $77,073,586 in 1932 to $68,188,353 in 1933, a drop of 11.5 per cent.

Net loss reduced

Improved operating efficiency is indicated, the report states, in the reduction of net loss to $8,636,841, compared with a 1932 loss of $8,903,540. The ratio of current assets to current liabilities stood at 16.6 to 1, current assets aggregating $75,379,755 and current liabilities $4,554,537. Surplus at the end of the year totaled $40,564,474, against $62,046,797 after all adjustments, including distribution of Radio Corporation of America stock as a dividend in 1933.

Inventories were $31,601,910, against $30,266,956 at the end of 1932. Unfilled orders at the beginning of 1934 amounted to $26,954,044. The investment in associated companies in 1933 decreased $15,713,941, of which $15,278,634 represented the cost of the common stock of Radio Corporation distributed as a dividend or sold.

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Profitable Year Predicted

Net loss of $209,684 in 1933 after all charges, including provision for bad debts, has been reported by the Century Electric Company. This compares with net loss of $289,000 in the preceding year. While operations in the final half of 1933 were profitable, they were not sufficiently so fully to offset the losses in the early part of the year. In a letter to stockholders accompanying the annual statement E. S. Pillsbury, president, said: "Barring unforeseen contingencies, there should be sufficient profit from current operations to justify the early resumption of quarterly dividends." The last disbursement on common stock was October 1, 1931. Mr. Pillsbury stated that the company entered 1934 with a volume of business on the books that promises a profitable half year.

Major New Construction This Week

Saginaw Premier Brewing Company, Saginaw, Mich., plans a $300,000 plant.

Guttenberg, Iowa, asks bids until April 10 for equipment for new city-owned Diesel electric light and power plant to cost $70,000.

Cloverdale Municipal Water & Power Corporation, Cloverdale, Ind., recently organized, has engaged engineer to make surveys and plans for hydro-electric power development on Eel River, to include transmission lines, substations, switching stations and distributing system. A $2,312,000 project.

Buffalo Springs Distilling Company, Stamping Ground, Ky., plans new multi-unit plant. Cost $150,000.

Motors, controls, elevators, electric hoists, conveyors, etc., will be installed in new $225,000 storage and distribution plant of General Grocery Company, Portland, Ore.

Marion, Va., plans city-owned steam-electric generating plant and electric distribution system to cost $221,000.

Corbin Brewing & Ice Company, Corbin, Ky., recently organized, will soon purchase complete equipment for new brewing plant, to develop capacity of 100 bbl. daily. Cost $200,000.

Tucson, Ariz., plans $322,500 city-owned electric light and power plant and has engaged engineer to make surveys.

Power substation, motors and controls for industrial shop service, electric hoists, pumping machinery, underground conduits and other equipment will be installed in new industrial training school for boys at Boonville, Mo., to be constructed by State Department of Education, Jefferson City, Mo. Cost over $1,000,000.

Kelvinator Shipments 300% Over February, 1933

With February deliveries to distributors by Kelvinator Corporation at a peak of 20,943 units, or 300 per cent of those for the corresponding month of 1933, Vice-President H. W. Burritt has announced this February to have been the best in the company's twenty-year existence.

"The February record exceeds the shipment record of any single month in the so-called boom years of 1928 and 1929," Mr. Burritt said. "Dealers and distributors in every section of the country are sharing our optimism over 1934 prospects, and we confidently expect 1934 to prove the biggest year the electric refrigeration industry ever has experienced."

In commenting on the February business of Leonard Refrigerator Company, a Kelvinator affiliate, Mr. Burritt reported shipments to have been 222 per cent of those in February last year.

MEN OF THE INDUSTRY

Sporn Named Vice-President of American Gas & Electric

Philip Sporn, for the past year chief engineer of the American Gas & Electric Company, has been advanced to the position of vice-president in charge of engineering. Mr. Sporn is eminently

qualified to assume these new executive duties. Starting in the engineering department of American Gas in 1920, he was made assistant to the electrical engineer within a short time and in this capacity was associated with the widespread engineering and construction work involved in the development of the present extensive interconnected system of the company.

After directing the engineering division of the electrical engineering and construction departments for four years, he was promoted to chief electrical engineer, and last year was appointed chief engineer in charge of both the electrical and mechanical engineering activities of the American Gas & Electric Company and its subsidiary companies. For a number of years Mr. Sporn has been active in committee work for the American Institute of Electrical Engineers and for other technical societies.

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Dr. Irving Langmuir, associate director of the research laboratory of the General Electric Company, has been appointed honorary chancellor of Union College, Schenectady, N. Y., for the current year.

John A. Darling has been appointed chief system operator of the Boston Edison Company, succeeding Pierce J. Kent, who retired recently after 47 years' service. Mr. Darling entered the company's employ in 1901 as a member of the generating department. In 1914 he became a load dispatcher with the establishment of that operating post in the company's production division, and three years later was made assistant chief system operator. He has been a leader in the New England System Operators Club from its inception.

Henry V. Faber, for the past six years secretary and treasurer of the Savannah (Ga.) Electric & Power Company, has been elected treasurer of the Gulf States Utilities Company, Beaumont, Tex. William L. Breslin, assistant secretary-treasurer, has been promoted to secretary and treasurer of the Savannah company.

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American Transformer Names T. M. Hunter President

Thomas M. Hunter, who has been connected with the American Transformer Company for twenty years, was elected president of that organization at a recent meeting of the board of directors. In the course of his long and distinguished association with the company Mr. Hunter has been intimately identified with its various activities. After

holding the position of manager of the industrial division of the company for several years, in 1933 he was made general sales manager. From 1929 to the time of his election to the presidency he occupied the position of vice-president.

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Harry A. Barr, lawyer of Urbana, was recently appointed by Gov. Henry Horner a member of the Illinois Commerce Commission.

Robert H. Habberly, since 1931 assistant superintendent of distribution for the United Electric Light Company, Springfield, Mass., has been advanced to the position of superintendent of distribution, to succeed the late Samuel A. Muldrew. Mr. Habberly brings to his new position an extensive knowledge of operating conditions in the New England territory, obtained through connections with the Malden Electric Company and with the Western Massachusetts Companies.

OBITUARY

J. H. Gulick

John H. Gulick, formerly vice-president in charge of finance of the Commonwealth Edison Company and the Public Service Company of Northern Illinois, died suddenly March 11 at his home in Chicago, in his sixty-eighth year. Mr. Gulick had been identified with the Insull organization continuously since 1905 until his retirement last month. He went to Chicago from Washington, D. C., his native city, in 1898, when he became associated with the Calumet Electric Company, which later was absorbed by the Commonwealth Edison Company. He remained only one year, but returning in 1905 he became Commonwealth auditor. Within a short time he had established a reputation as an authority on electric-service organization and accounting and in 1914 he was promoted to the position of vice-president in charge of accounting. To these responsibilities was added the executive duties of chairman of the company's finance committee in 1930. He had been connected with the Public Service Company since its formation.

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Walter D'Arcy Ryan, for a number of years head of the General Electric Company's illuminating engineering laboratory at Schenectady, died March 14, according to a news dispatch received as the Electrical World went to press. Mr. Ryan was internationally known for his work in designing the illumination of the Panama-Pacific International Exposition and for his valuable contributions to the spectacular illuminating schemes at the recent Chicago Fair.

Francis E. Tyng, electrical and mechanical engineer and New York representative of the Euclid Armington Corporation of Euclid, Ohio, manufacturer of hoisting machinery, died March 7 at his home in Norwalk, Conn. Mr. Tyng obtained his early experience with the old Thomson-Houston Electric Company at Lynn, Mass., and Schenectady, N. Y., and subsequently became an employee of Thomas A. Edison in the famous Edison laboratory. Later in his career Mr. Tyng had charge of the crane department of Manning, Maxwell & Moore. He was 66 years of age.

NEW EQUIPMENT

Prepayment Time Switch

Coin-operated time switches for heavy appliance service are announced by the General Electric Company. Their purpose is to disconnect a refrigerator or other device unless periodic installments are paid. The plug of the refrigerator service cable is inserted and locked in the switch receptacle and the switch

inserted in the usual outlet. Twenty-five-cent coins are credited by dropping them in a slot in the top of the switch and depressing a lever; fifteen coins can be credited in advance of use and the switch capacity is about 100 coins. The number of coins ahead is visible through a window. Measuring 6¼ in. high by 5¾ in. wide by 4 7/16 in. deep and weighing 5 lb., these switches are stocked in the 115-volt rating, but can be had for other common ratings. The standard time interval is one 25-cent piece per 24 hours, but eight intervals of 6 to 48 hours are available. Intervals can be changed by altering the gear ratio.

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SERIES-PARALLEL LAMP TEST SETS for use as trouble lamps by meter men, line cars and trouble men, and identified as C & E test sets, are announced by the Ericson Manufacturing Company, Cleveland. They are provided with heavy-duty bakelite lamp sockets, 24-in. leads of No. 16 special flexible high-grade rubber-covered cord and are attached with cadmium-plated test clips with insulators.

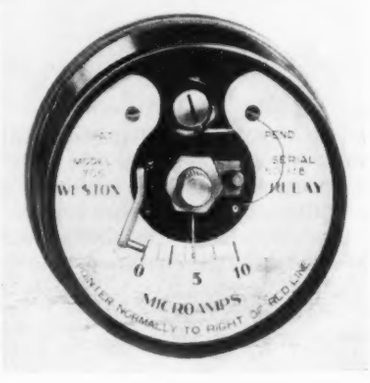
SELF-STARTING SYNCHRONOUS TIME SWITCHES in a new series of seven models developed to meet the demand for a small, low-priced unit have been announced by the Paragon Electric Company, Chicago. Circuit ratings are up to 1,600 watts. With only four gears and pinions, the time movement is claimed to be of the utmost simplicity. There are no friction slips between the removable dial and the motor, a feature which, it is stated, completely eliminates dial slippage. The switch may be manually operated at any time to turn the circuit on or off without disturbing the time setting or operation. The case is of pressed steel with six replaceable knockouts in sides, base and back. The series is available to manufacturers and distributors on a contract basis.

Electric Delivery Trucks

Light weight, compact, economical and rugged electric delivery trucks for ¾- to 1-ton service are announced by the Walker Vehicle Company, Chicago, a division of Yale & Towne Manufacturing Company. Location of the entire battery at the front of the chassis and the use of the parallel driven axle are features, giving unobstructed access to the loading space from rear or sides of the chassis. Model 401 with straight frame and Model 410 with low aisle for retail work are offered. The motor is mounted directly on the rear axle housing. The usual differential space is used for double reduction gears. Either low-speed high acceleration or high-speed drive are offered, with maximum road speeds from 16 to 21 m.p.h.

Sensitive Relay Improved

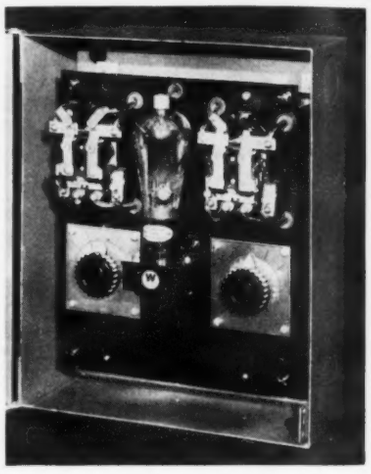
For handling power up to five watts at 110 volts a supersensitive relay, Model 705, has been announced by the



Weston Electrical Instrument Corporation of Newark. This relay, whose contacts can handle non-inductive load at the above conditions, will have application with photo-electric cell industrial control or with thermocouples for temperature control. It will make contact on values down to three microamperes or one millivolt and is the first sensitive relay capable of handling five watts energy.

Electronic Timers

For timing spot and projection welder current flow, X-ray work and similar uses Westinghouse Electric & Manufacturing Company has announced the type



HA electronic timer. This device is unusually rugged with industrial grid glow tube designed for long life and operates as contactor without relays; tube is free from any temperature effects. Timing is adjustable 1/10 second to 45 seconds from the initial impulse until contacts close or open. The contactor has a capacity of 10 amp. at 115 volts and 5 amp. at 220 volts alternating current. For high-accuracy applications, such as welding, provisions can be made to eliminate entirely the errors inherent in the closure of contactors so that timing is started from the instant the contactor closes rather than when the control switch is closed.

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RUSTLESS, CORROSION-RESISTANT ELECTRICAL CONDUIT, identified as "Everdur," has been announced by the American Brass Company, Waterbury, Conn., for locations where ordinary conduit has a very short life or where sparks and arcs present a dangerous hazard. The conduit is made of Everdur metal, which is mostly copper with controlled proportions of alloy elements. Its strength is comparable with mild steel; it is tough, ductile and resistant to shock and stress. The completed conduit has passed all required tests of the Underwriters' Laboratories. Accurately drawn to size for use with threadless fittings now available, Everdur conduit is furnished in standard 10-ft. lengths in seven nominal sizes from ⅜ to 2 in. in diameter.